Electrical World

Published by McGraw Publishing Company, Inc.

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

Vol. 63 NEW YORK, SATURDAY, JANUARY 17, 1914 No. 3

Engineers in Regulation

The discussion at the Stevens Institute of Technology reported in our news columns this week had as its subject "The Engineer's Part in the Regulation of Public Utilities." The real question is whether the engineer shall have more of a part in the future than he has had in the past; that is to say, more of an influence in regulative policies. Generally the place of the engineer has been that of a member of the commission staff. He has made investigations on which decisions were based. No doubt, the engineer, though an employee, has exercised as much wholesome influence in some cases as he could have done had he been a commissioner. The circumstances that permit so strong an influence by a subordinate are not found in all of the commissions. As a member of a commission the engineer would have a vote. If outvoted by his associates, he could express his views in a dissenting report. The object of engineer membership on a commission, however, is not to create dissension; it is to make decisions fairer and to make the policy of regulation effective for both the public and the corporation. The reason why engineer membership should do this is that the problems submitted to commissions are largely of an engineering character. There should be a public demand for the appointment or election of engineers on the board. That there has not been such a demand is due in part to public ignorance of engineers and their great works. The correction of this is education of the public.

The Low-Priced Electric Vehicle

The announcement that a six-hundred-dollar electric automobile is to be put on the market by a Detroit manufacturer who now turns out gasoline cars at the rate of a thousand a day has a lesson for the vehicle makers in the field he proposes to enter. Its significance is, however, even larger to the central-station industry, which will be the chief beneficiary of the innovation. For years electric-vehicle manufacturers have been urged to develop an electric car which could be sold at a price within the reach of the average American family. But, in spite of this expressed demand, the price of electric vehicles has been forced up, year by year, and luxuries have been piled on until the idea of a poor man's car has in most cases been quite lost sight of. Statistics show that about 1,000,000 families in the United States have incomes of approximately $3,000 per year. With prudence such an income should make an electric vehicle costing less than $1,000 not only an attainable luxury but a family convenience. Consider what a market this great group offers for the low-priced electric automobile in comparison with the restricted élite class for whom the luxurious vehicles of to-day are largely designed. At last, however, the electric vehicle is to have its chance under the long-denied advantages of a low price and quantity production, and it is not likely, either, that the field of this "everyman's" car will long be limited to any single manufacturer. In keeping with its lighter weight such a car will probably show a reduced consumption in kilowatt-hours, but in the quantity in which the low-priced electric vehicle is likely to be utilized lies such a central-station opportunity as even the most optimistic has not yet dared to predict.

Concealed Pole-Type Transformers

The number of transformers required in the lighting service of the Commonwealth Edison Company, Chicago, is very large and increasing rapidly. Many of the transformers are located in the residence and downtown business districts where civic pride demands attention to appearance. While the standard outdoor transformer has been greatly improved in this respect since the late eighties when alternating-current lighting service on any considerable scale was accompanied by the decoration of a building with a row of conspicuous transformer cases and unsightly wiring, there is still room for improvement. The placing of transformers in ornamental cylindrical cases in streets is not new, handsome construction of this type having been used quite early in the history of alternating-current lighting. These booths, however, were designed merely to conceal the transformer and at the same time render it accessible. The new transformer pole designed by engineers of the Commonwealth Edison Company, described on page 154 of this issue, appears to have most, if not all, of the advantages of the older plan while requiring much less space. The principal advantage of the new scheme is the ease with which a large radiating surface can be provided by using a considerable oil depth. This arrangement permits the use of a lighter transformer for a given output. Whether the reduction in cost thus resulting will offset the increased cost due to the necessary use of a steel pole is a manufacturing problem. The answer will depend partly upon the extent to which the plan takes the fancy of the central-station managers. It is, at any rate, an interesting example of the application of simple and direct methods in solving the live problems of electrical energy distribution.

The Growth of Central Stations in Germany

Some particularly instructive information regarding the development of the central-station business in Germany is contained in a recent statistical report in the *Elektrotechnische Zeitschrift* covering the past sixteen years, in other words, nearly the whole period of modern central-station practice. Looking back over the tables, it is hard to realize how great and rapid has been the progress in the construction of electrical supply stations in a single active country. German statistics have been well kept, so that, while no statistical report is impeccable, the figures before us are probably quite as reliable as any such data can reasonably be expected to be. There are to-day a few more than 4000 stations in the German list, as against 148 in 1895. This growth in numbers is sufficiently startling, but it becomes more so when one realizes that within the last two years there have been put into service more electricity works than the total number in existence half a dozen years previously. The total load at present is approximately 3,750,000 kw, of which about 36 per cent is in arc and incandescent lamps, about 43 per cent in stationary motors, and the rest in a somewhat scant railway supply and miscellaneous appliances.

The total loads are less interesting than the story told by the variations in practice. For example, the great motor load is a growth in comparatively recent times. In the last seven years it has increased almost sixfold, twice as fast as the load of incandescent lamps. In the last four years, however, the incandescent-lamp load, thanks evidently to the introduction of the metallic-filament lamps, has doubled, just about keeping pace with the increase of motor load. The effect of a striking change in the art is in no wise more clearly shown than by this sudden variation. Meanwhile the arc-lamp business has failed to hold its own. It reached its maximum in 1911 and now has fallen off by 5 per cent or 6 per cent, with every probability of further decrease. A very noticeable similar decrease is in the aggregate rating of the stations for direct current and alternating current respectively. The pure direct-current systems reached the top of their rating four years ago and have since fallen off by nearly 20 per cent. In the same period the rating of the alternating-current plants has increased considerably more than fourfold, and that of the mixed systems employing both kinds of current has nearly doubled. As might be expected from this tendency, the use of storage batteries, while not absolutely on the decrease, is relatively waning. Only 24,000 kw is recorded as added in the last four years, while in the four previous years the additions were 65,000 kw. Since 1911, in fact, there are only about 2000 kw recorded as added to the central-station equipment, and by far the greatest proportion of this amount is found in the works with mixed distribution.

With respect to the systems used, the rating of the pure direct-current plants averages only about 150 kw, showing the effect of very local distribution, while the usual city plant is of the mixed direct-current and alternating-current or three-phase type. Many small stations have sprung up in the last few years, and there are now between 1100 and 1200 having a rating of not over 100 kw. The total output of all the plants for which statistics are available for the last year of record was very nearly 2,000,000,000 kw-hr. From the inspection of these various data the general trend of German central-station practice is fairly evident. The increase both in motors and incandescent lamps is very rapid, the arc-lamp business is falling off as might be expected, pure direct-current distribution is being pushed to the wall by the three-phase and mixed distributions, and in the case of the latter the small increase of storage-battery plants shows plainly that the growth is in the alternating-current part of the work. There has been recent rapid increase in the number of hydroelectric transmission systems which has been a powerful factor in the relative increase in three-phase plants, but the absolute decrease in the direct-current equipment cannot be thus explained and must be charged to the working over of inefficient equipment into that better fitted for the requirements of modern energy distribution.

Sources of Energy for Electrochemical Processes

One of the advantages of an electrochemical plant load, from the standpoint of the power-house manager, is that its ratio of average to maximum load may approach unity. That is, the load, under favorable conditions, may be nearly constant day and night. If operated in connection with an electric-lighting system, it may even happen that the electrochemical load will permit of being greatly reduced during the peak hours of the evening lighting, but such a joyful combination of happy conditions rarely falls to the lot of mortal managers.

One of the disadvantages of a large electrochemical load is that it is not easy to build large direct-current generators to be driven by steam turbines. Steam turbines, as is well known, are essentially addicted to high rotary speeds, and heavy-current electrolytic commutating generators do not take kindly to such speeds. In the paper by Mr. F. D. Newbury, read last week before the American Institute of Electrical Engineers and abstracted in this number, the various methods of supplying continuous current for large electrochemical loads are discussed. The conclusions are that with steam turbines as prime movers it is desirable at the present time either to drive large direct-current generators through reducing gearing or to employ synchronous converters, especially when the distance between the electrochemical plant and the power house is considerable.

Since the direct-current strength supplied in electrochemical processes is often very large, the conducting mains are apt to be very heavy, so that it is essential to place the direct-current generators close to the load.

If large reciprocating gas engines should come into extensive commercial use for power-house generator driving, the particular difficulties of connecting large direct-current generators with their prime movers would disappear. It is probable that on account of its simplicity the steam turbine will be able to maintain a strong hold on the field against all types of large reciprocating engines. On the other hand, considerable improvement has been made during recent years in the design of large homopolar commutatorless direct-current generators, driven by steam turbines, although there is still much room for further development in this direction.

Methods of Checking Meter Connections

When a single-phase wattmeter is connected in the ordinary way, between a pair of single-phase supply mains and a single load, it is always possible, theoretically, to trace out the connections of the instrument beforehand, so as to insert it correctly for measuring the power delivered to the load. But the task of tracing out the leads is sometimes troublesome and can be avoided entirely if, as ordinarily happens, the pair of potential leads can be distinguished from the pair of current leads. All that has to be done is to connect these pairs of leads respectively to the proper pairs of binding posts on the instrument, making sure that both the impressed voltage and the current are within the instrument's compass, and see what happens. If the instrument pointer moves over the scale, the connection is right. If, on the contrary, it moves backward, the connection is wrong. In other words, it is not possible to connect the wires up reversed, if the wattmeter is of the ordinary type and gives a reading on the scale. The inherent probability of making the first connections right is equal to that of making them wrong, or the chance of initially establishing a correct connection is 50 per cent. Similar reasoning applies to the connection of a single-phase watt-hour meter, except that as such apparatus is ordinarily constructed and internally connected, there can be no mistake when the directions accompanying the instrument are followed in ordinary low-tension installations.

In the case of the insertion of either a polyphase wattmeter or a pair of single-phase wattmeters to measure the power transmitted along three-phase mains, the conditions are known to be quite different. As before, it is theoretically possible to predetermine the correct wiring by a process of ratiocination. Assuming that the two pairs of potential leads and the two pairs of current leads are correctly labeled, the initial chance of making a correct connection, without thinking the matter out, is only 25 per cent, while actually, with some uncertainty among the leads, the chance is still smaller. Many persons have it in their working philosophy to believe that life is too short to admit of the ratiocination, and that the experimental method of trial and error pays better. This essentially pragmatic philosophy may not, however, be trusted too far. If the power-factor of the load is in the neighborhood of 100 per cent, as in simple incandescent lighting, then all that is necessary is to connect up each of the two wattmeter circuits separately and see that the pointer in each case moves forward over the scale, just as in the single-phase case. The total power is then, of course, the sum of the two readings. If, on the other hand, the power-factor of the load is low, as in the supply of energy to underworked induction motors, it may well happen that one of the two wattmeter readings is negative, although its scale reading is positive, and then the power supplied is the difference of the two meter readings instead of the sum. The error that may thus be made in determining three-phase power or energy is sometimes very serious. It applies to both wattmeters and switchboard watt-hour meters. We present this week two articles on practical means for insuring against such misconnections. One is by Mr. P. Ackerman, in relation to wattmeters, and the other by Mr. Raymond S. Brown, in relation to watt-hour meters. The two methods are easily remembered and easily carried into effect, although they are quite distinct. Of the two methods, the latter depends upon the fact that the ordinary watt-hour meter has a large inductive reactance in its potential circuit.

Evolution of a Transmission System

Those who are interested in the phases of growth displayed in electric service will read with appreciation the story in this issue of the evolution of the Menominee and Marinette system. The work done in this district is absolutely typical of what has frequently built up a considerable industry out of the praiseworthy attempts of former days. More than half a dozen companies of earlier times—electric, railway and gas—finally came together, merging interests and uniting plants as far as might be, and finally the whole work of the district has been transferred to a modern hydroelectric plant of nearly 5000 kw, situated some 20 miles from the center of activity, a distance so great as to have been almost unthinkable in the days when the first of the amalgamated plants made its start in business. It is a plant working at moderate head, very workmanlike, but not necessitating any specially novel equipment. One thing worth noting, however, is the exemplification here of the increasing tendency to acquire private rights-of-way even for comparatively small systems. Such rights-of-way are easier to obtain now than they used to be, on account of the disappearing prejudice against high-tension transmission, and once acquired they give a certain sense of security, particularly in a somewhat wooded country. The danger from tree troubles almost always present along the highway is vastly reduced, and where the right-of-way is fairly accessible it is patrolled without difficulty even when not on a sufficient scale to justify the employment of an aviator as patrolman, an improvement already instituted on one of the great Pacific Coast systems.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Plan for Anti-Trust Legislation

It was authoritatively announced in Washington on Jan. 14 that the forthcoming Presidential message to Congress will outline a plan for an interstate trade commission. According to the announcement the commission will be designed principally to make inquiries and give information and will not have power to fix prices or exercise as much supervision over industrial affairs as does the Interstate Commerce Commission over railroad affairs. Interlocking directorates will be prohibited. Punishment will be sought for individuals responsible for monopolies.

Thomson on Wireless Transmission

Dr. Elihu Thomson will be the chief speaker at a joint meeting of the New York Companies' Section of the National Electric Light Association and the New York Electrical Society to be held in the Edison Auditorium, 44 West Twenty-seventh Street, New York, on Monday, Jan. 19, at 8 p. m. His subject will be "The Wireless Transmission of Energy," the lecture being illustrated with lantern slides.

Engineering Departments of Harvard University and Massachusetts Institute of Technology Merged

The engineering departments of Harvard University and of the Massachusetts Institute of Technology are to be combined as the result of an agreement reached on Jan. 9. By the agreement the combined departments of mechanical engineering, electrical engineering, civil and sanitary engineering, and mining engineering and metallurgy are to be conducted in the new buildings of the Massachusetts Institute of Technology now in process of erection in Cambridge. Harvard University is to discontinue its schools of applied science in these departments. The president of the Massachusetts Institute of Technology is to be the executive head of the co-operative work, and the faculty will comprise the faculty of the Massachusetts Institute of Technology enlarged by the addition of Harvard professors of the departments involved. Provision is made that when in the future the corporation of the Massachusetts Institute of Technology selects a president the president of Harvard University is to sit with the committee on selection. It was announced that both institutions are to remain absolutely unaffected in name, organization and in the title to property.

Massachusetts Institute is to furnish the buildings, laboratories and equipment together with contributions from its special and general funds, while Harvard is to give some equipment and the interest on funds that it holds for education and research in these departments. As soon as the new buildings of the Massachusetts Institute of Technology are finished (about the middle of 1916) Harvard University will send all its engineering and mining faculty, students and plant there, using the present engineering and mining buildings for other Harvard purposes. The advantage of the plan is that it will terminate duplication and rivalry between the two institutions, all the Massachusetts Institute engineering and mining faculty members becoming at once professors of both the Massachusetts Institute of Technology and the Harvard University. The total student enrolment in Harvard University will forthwith be increased by some 600. According to President MacLaurin of the Massachusetts Institute of Technology, it will be possible to maintain under the scheme of co-operation outlined above a much stronger school of applied science than either institution alone can furnish, and it will be possible to keep that school practically unrivaled in America, if not in the world.

Progress of Inspectors' Convention at Cincinnati

At the ninth annual meeting of the Western Association of Electrical Inspectors at the New Hotel Gibson, Cincinnati, on Jan. 27-29, the president's address will be delivered by Mr. Ben W. Clark, and committee reports will be presented as follows: Executive committee, Mr. William S. Boyd, secretary of the association; "National Electrical Code," Mr. F. D. Varnam; "Outside Wiring," Mr. M. E. Cheney; "Theater Wiring," Mr. F. L. Lucas; "Show Window and Display Wiring," Mr. F. P. McGough; "Electric Traction Systems," Mr. Frank R. Daniel; "Installation and Operation of Induction Motors," Mr. K. W. Adkins; "Architects' Specifications," Mr. F. H. Moore; "Signal Systems," Mr. Frank S. Anderson; "Rubber-Covered Wire," Mr. V. H. Tousley. In addition there will be papers on "Practical Car Wiring," by Mr. C. H. Anderson, and "The Incandescent Lamp and Its Circuit," by Mr. R. W. Shenton. There will be a complimentary smoker on the evening of Jan. 27 and a dinner on the evening of Jan. 28. For those attending the convention from Chicago and its vicinity arrangements have been made for a special sleeper on the train of the Pennsylvania Railroad leaving Chicago at 11:45 p. m. on Jan. 26.

Mr. Ford to Build a Light, Low-Priced Electric Automobile

Applying the methods of light construction, large-scale production, and low selling price which have characterized the Ford gasoline automobile, Mr. Henry Ford, Detroit, Mich., will shortly begin the manufacture of a light electric automobile to be sold at about $600, according to statements obtained from reliable sources, including Mr. Ford himself.

The new "Ford electric" will be built in a separate factory under the management of Mr. Ford's son, Edsall, and all manufacturing operations will be carried on entirely distinct from the present organization of the Ford Motor Car Company, Detroit, Mich. It is

proposed to produce a runabout type of car weighing 1100 lb., including the 405-lb. storage-battery equipment. Edison nickel-iron cells will be used. A car of the type described has already been built and is now in experimental use on the streets of Detroit. Runs of 100 miles per charge will be possible with the new light-weight vehicle. The methods of unit production on a large scale which have distinguished the Ford factory at Detroit (where 1000 gasoline cars are now turned out daily) are to be applied in the manufacture of the new electric vehicle, and assurance is given that the selling price of the complete battery-driven car to the public will be less than $1,000, perhaps as low as $600.

Mr. Ford spent several days in New York City just prior to putting in effect the plan to divide $10,000,000 with his employees, establishing a minimum wage of $5 per day in the Detroit factory, and he took advantage of his visit in the East to call on Mr. Thomas A. Edison at the latter's laboratory in West Orange, N. J., where plans for a light, low-priced electric car were discussed. Mr. Ford also plans to visit Mr. Edison in Florida during February.

Annual Messages of Governors to Legislatures

The annual messages sent by some of the governors of states to legislatures contain references to public utility regulation and to other matters affecting public service corporations. Following are extracts from the messages of the Governors of Rhode Island and Maryland:

Governor Pothier of Rhode Island

Gov. Aram J. Pothier of Rhode Island called attention to acceptance by 2018 establishments in the State of the workmen's compensation act. He says that an educational campaign based on a careful study of the character and causes of more than 11,000 accidents should be of practical benefit and a material factor in the elimination of a number of the apparently unnecessary accidents occurring almost daily in manufacturing and other industrial establishments.

Amendment of the public utilities commission law is recommended so as to require every public utility to render to the commission uniform accounts of all business transactions in such manner and form as the commission may prescribe.

Governor Goldsborough of Maryland

Gov. Phillips Lee Goldsborough of Maryland said that a workmen's compensation act was passed at the last session of the Legislature, but because it did not seem to suit conditions it proved ineffectual. In order that the matter might be considered, the Governor appointed a commission whose report, with a recommended draft of a new bill, will be made the subject of a special message.

Success of Electric Parcel-Post Delivery at Indianapolis

Rented to the Indianapolis post office authorities to "help them out of a hole" in the delivery of parcel-post packages, two Waverley electric vehicles have been giving such satisfactory service in comparison with a pair of gasoline cars that the latter are now to be discontinued and their places taken by electric trucks. The first two "electrics" have now been in operation about ten months, and on Sept. 1 a third was added.

It was after the gasoline vehicles first used in delivery work at Indianapolis had proved unsatisfactory that the local manufacturer was asked to supply electric trucks for the same purpose. One of the stipulations made was that these trucks should have sufficient mileage for the out-of-town and suburban work required of them. The machines were not sold to the government, but were rented on an hourly basis, the Post Office Department itself furnishing the driver. The batteries were kept up by the owners, who also made all repairs except in case of collision. At the rate at which the cars were rented a satisfactory profit was earned.

Comparing the performance of the electric vehicles with that of the gasoline cars, as noted in our issue of

DELIVERY WAGON AT INDIANAPOLIS

Dec. 27, the cost per parcel-mile was 0.00137 cent for the gasoline cars and 0.0011 cent for the electric trucks, thus showing a saving of almost 25 per cent in favor of the battery-propelled wagons. In an eight-and-one-half-hour day the gasoline cars delivered, for example, 136 packages during 135 stops in a run of 45.6 miles. Meanwhile, in a seven-hour working day the electric wagons had averaged 271.5 parcels in 189 stops over a distance of 18.75 miles. The cost of the day's run in the case of the gasoline cars was $8.50 per truck, not including the wages of the carrier, and for the electric wagons the cost was $5.60. The table compares the unit costs for the two classes of service.

OPERATING COSTS OF GASOLINE AND ELECTRIC CARS IN PARCEL-POST SERVICE

	Gasoline	Electric
Stops per mile	2.94	6.02
Cost per stop, in cents	6.36	3.26
Cost per parcel, in cents	6.30	2.06

The electric delivery wagons in the service of the Indianapolis post office have proved very reliable and, it is declared, have never failed to perform any service they have been called upon to do. The gasoline cars, on the other hand, as shown by experience, could not be depended upon. In point of speed the travel of the electric cars has been found ample for parcel delivery, for the requirements in this direction are not great. As the result of the satisfactory service rendered by the present fleet of three "electrics," the Indianapolis post office authorities have asked the Waverley company to furnish additional vehicles on the same basis.

Power Problems in the Electrolytic Deposition of Metals

A joint meeting of the American Institute of Electrical Engineers and the New York sections of the American Electrochemical Society and the American Society of Mechanical Engineers was held at the Engineering Societies Building, New York City, Jan. 9, the subject for the symposium being "Power Problems in the Electrolytic Deposition of Metals." President C. O. Mailloux of the American Institute of Electrical Engineers presided as chairman of the session and called first upon Mr. Lawrence Addicks, superintendent of the United States Metals Refining Company, Chrome, N. J., for a discussion of the conditions imposed by commercial practice in the electrolytic refining of copper as a typical process.

Limitations Imposed by Commercial Electrolytic Practice

By far the larger proportion of the world's copper is electrolytically refined, said Mr. Addicks, and this work is almost exclusively an American industry, centered chiefly in big plants on New York Harbor. When using soluble anodes in copper refining, 95 per cent of the emf is absorbed by the ohmic resistance of the circuit and measures in general about 0.3 volt per cell. With peroxidized lead or similar insoluble anodes in

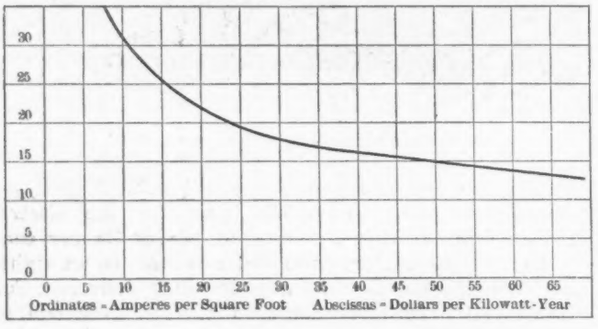


FIG. 1—RELATION OF CURRENT DENSITY AND COST OF ENERGY

sulphate solutions, about 2 volts per tank is required to maintain the same current density. The power limitations specified by the author for copper refining are as follows: (a) direct current; (b) 8000 amp to 15,000 amp; (c) 100 volts to 200 volts per circuit; (d) units of 1000 kw to 1500 kw; (e) circuits electrically independent to avoid cross-leakage; (f) constant current, with 20 per cent variable voltage; (g) continuous operation twenty-four hours a day; (h) steam required for heating the electrolyte; (i) plants of 3000 kw to 9000 kw total rating should be considered.

The current density to be used is fixed by the balance between the interest on the copper tied up, the cost of energy and the difficulties in practical handling of the rough deposits. The relation for American practice is shown in the accompanying curve, Fig. 1. In the vicinity of New York density values of about 20 amp per square foot of active cathode surface are generally employed, resulting in an average consumption of about 1 kw-hr. for each 8 lb. of copper deposited. As many as thirty pairs of electrodes each 3 ft. square are now used in single tanks, calling for currents of about 10,000 amp. Owing to the desirability of limiting current leakage between sets, Mr. Addicks recommended the use of motor-generators instead of rotary converters in any scheme for distributing power from a large unit over several circuits.

The electrolytes used have high positive temperature coefficients, so that in addition to the heating due to the energy dissipated in the tanks (which would alone maintain a temperature of 90 deg. to 100 deg. Fahr.) it has been found advantageous to add sufficient steam in closed-coil heating tanks to keep the electrolyte at an average temperature of about 130 deg. Fahr.

Fig. 2 shows the results that can be expected from 1200-kw units of the types noted, excluding steam for operating condensers. The installation cost of such plants may be taken roughly at $100 per kw, including the disproportionate boiler apparatus. Among the possible future sources of power for electrolytic plants, as enumerated by Mr. Addicks in closing, are gas-driven units, large capacity turbo-alternators driving smaller motor-generators, compound reciprocating engines exhausting into a main from which exhaust-steam turbines are fed, multiple-expansion reciprocating engines, turbine-driven unipolar generators, or some combination of these.

Prime Movers for Electrolytic Generators

In his paper on "The Mechanical Side of the Problem," Mr. H. E. Longwell, consulting engineer, Westinghouse Machine Company, East Pittsburgh, Pa., pointed out the fact that any engine the exhaust steam of which is fully utilized can be considered as operating at 100 per cent efficiency. Comparing the performance of a steam-turbine plant with a gas-producer installation, each made up of 1500-kw units and operating at high load-factors, the author estimated that, using a good grade of fuel containing 14,500 lb.-Fahr. heat units per lb., the gas-producer plant would probably show a saving of ½ lb. of coal per kw-hr. over the consumption of the steam-turbine station. With coal at $3 per ton, this saving of 2 tons per annum would effect an economy of $6 per kw-year, to gain which an extra investment of about $50 per kw would have to be made over and above the cost of the steam-turbine plant. Making annual allowances of 8 per cent for interest, 1 per cent for taxes, 1 per cent for insurance, 2 per cent for maintenance and 8 per cent for sinking fund, 18 per cent would be required to insure a return on the investment. As 20 per cent would be desirable, Mr. Longwell pointed out that the saving of $6 per kw-year effected by the gas-producer units could not be justified unless the differences in initial cost were $30 or less per kw of installation. Although it is common practice in copper-refining plants to allow 50 per cent of the steam for the main generating units, 25 per cent for the auxiliaries and 25 per cent for heating the electrolyte, the author declared that since the auxiliaries extract but little useful heat from the live steam, their exhaust can be used advantageously for heating, so that the entire amount for auxiliaries and heating need be only about one-half that required for the main prime movers. In the case of one copper-refining plant which he cited as turning out 500 tons per day the waste heat from the flue gases of the reverberatory furnaces alone is capable of furnishing 50,000 lb. of steam per hour. This steam represents about 40 per cent of that required to run the entire plant and is sufficient for all the requirements of the auxiliaries and the heating of the electrolyte.

Commenting on the theoretical advantages of arranging reciprocating compound engines to exhaust into low-pressure turbines, Mr. Longwell pointed out that the low-pressure turbine costs about 75 per cent more per kw than the complete-expansion unit. Few triple-compound engines, he thought, are enough better than two-cylinder units to make the addition of the intermediate cylinder worth while.

The development of a highly efficient transmission gear for turbines has now made possible the efficient turbo operation of direct-current generators. Several of these geared sets have already been in continuous service for several years, the best known examples being those at San Diego, Cal., Cleveland, Ohio, and Louisville, Ky. While a turbine-driven direct-current unit is more expensive than an equivalent direct-current alternator, it is nevertheless cheaper, said Mr. Longwell, than the combination of turbo-alternator and rotary converter advocated by another speaker.

With careful supervision a plant of 6000 kw to 9000 kw should be built for about $75 per kw, said Mr. Longwell. Burning coal at $3 per ton and allowing 10.5 per cent for investment charges, it should be possible at 100 per cent power-factor to produce energy at the switchboard for 4.3 mills per kw-hr., "more or less."

Electric Equipment for Electrochemical Processes

The paper on "Sources of Direct Current for Electrochemical Processes" prepared by Mr. F. D. Newbury, New York, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., outlined various methods of producing energy required for electrochemical processes and pointed out the problems involved in each method of generation, including a comparison of the efficiency, first cost and reliability of the systems.

Because of the high speeds of preferred prime movers and the continuous full-load and large-current requirements of the electrolytic industry, it is difficult to design suitable direct-current commutating machines. Since the current output of such generators is proportional to the number of armature circuits in parallel, the rating is limited only by the peripheral speed and length of the commutator and by the number of current-collecting brushes which can be used.

Three methods of clamping commutator segments were enumerated; these comprise the V-ring and shrink-ring constructions and combinations of the two. The plain V-ring method has the advantage of simplifying commutator-repair work while the shrink-ring type can be used only on relatively small-diameter commutators.

Where large currents are to be delivered to a point 1000 ft. or more away from the generator, it is better to transmit with alternating current at high voltage and use synchronous converters at the delivery end. For the adjustment of pressure to maintain constant current direct-current generators have the advantage of simple field-current control. If not more than 5 per cent regulation is required, the voltage of synchronous converters can be similarly controlled, provided the alternating-current circuit has sufficiently high reactance. Alternating-current boosters can also be used to vary the direct-current voltage of synchronous converters. As direct-current generators carrying an electrochemical load are usually required to operate continuously at full load, they should be designed particularly for commutation.

For generating energy at high current ratings four methods involving the use of steam-turbine prime movers have given satisfaction. Because of the inherently high speed required for economical turbine operation and the relatively low speed of commutator generators, gear-connected generators have given more satisfactory results than direct-connected units. The ordinary simple process of current collection in unipolar machines becomes more difficult with increased speed and large-current requirements and therefore unsuits this type of generator to very large installations. The alternating-current generator combined with a synchronous converter gives the best all-round method, especially in large plants where energy has to be transmitted any distance or where water-driven prime movers are used. Tank circuits can then be segregated by employing separate transformers and converters on each group.

Discussion

Among those who took part in the discussion were President C. O. Mailloux and Messrs. H. B. Coho, C. A. Roush, F. A. Lidbury, F. L. Antisell, J. B. F. Herreshoff, J. B. Herreshoff and C. H. Vom Baur.

Mr. Lidbury declared that some of the power-plant examples given by the authors, rated as high as 120,000 hp, are far larger than the practical requirements of any existing electrolytic plant. Most such electrolytic plants, except in the aluminum industry, have power demands ranging from 1000 hp to 10,000 hp. He also commented on the selection of voltages for water-wheel-driven generators and advocated direct-current generation and transmission, even for considerable distances, pointing out difficulties in the way of alternating-current generation with rotary-converter transformation. Economically, added Mr. Lidbury, it is obvious that operating costs will be practically doubled by maintaining two stations containing moving machinery, while maintenance charges will also be considerably increased. Moreover, the electrochemical engineer, he said, is apt "to have an absurd prejudice in favor of simplicity."

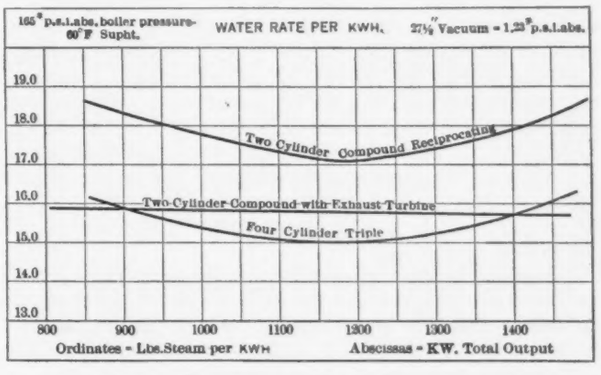


FIG. 2—WATER RATES OF VARIOUS PRIME MOVERS

Generally, the electrochemist has enough operating problems of his own without desiring to assume in addition the troubles of a central-station superintendent which are likely to result by multiplying the electrical links in his chain of power machinery.

Mr. Antisell called attention to the high operating efficiency of reciprocating engines at partial loads as compared with turbine units.

Mr. J. B. F. Herreshoff told of the varied experiences of his company in using several types of prime-mover sets, including a couple of 2000-kw turbine-driven homopolar machines. These units gave much trouble at the collector rings and brushes and exhibited heat losses amounting to 30 per cent of the input. His nephew, Mr. J. B. Herreshoff, about this time conceived the idea of employing a low-voltage alternating-current generator, the output of which was rectified, without voltage transformation, by a properly designed rotary converter. The idea did not at first meet with favor among the engineers of the large manufacturers, but was finally accepted and is now in general use for electrolytic work.

Mr. J. B. Herreshoff, who followed his uncle on the floor, said that by doubling the density of current flow twice the amount of copper will be deposited in a given time. This requires double the voltage and thus four times the power, but has the advantage that the electrolyte is automatically kept warm without the use of steam. Although the power requirement is

quadrupled, the cost per pound of copper is only doubled, but objections are found in the roughness of the deposit, which becomes crystalline and brittle when formed at high densities. Where two rotaries are supplied from one generator differences in voltage can be obtained by weakening the field of one converter slightly, while strengthening the field of the other. An objection to this method is in the unequal heating of the rotary-converter armature, which may become serious if the difference in pressure is run above 30 volts to 40 volts.

President C. O. Mailloux said that it is actually possible to obtain good copper or bad copper deposits at almost any current densities from 10 amp per sq. ft. to 1000 amp per sq. ft. In 1885 he conducted experiments to produce electrotype shells at a rapid rate. These shells had formerly been deposited at the slow rate of 5 amp to 20 amp per sq. ft., taking two or three days. As the result of a series of experiments during which the circulation, strength and temperature of the solution were carefully controlled, it was found possible to deposit copper at the rate of 1000 amp per sq. ft., obtaining beautiful homogeneous products. Later, in connection with the manufacture of copper tubes, deposition rates of from 3000 amp to 6000 amp per sq. ft. were readily obtained. It is theoretically possible, in spite of the apparent paradox, said Mr. Mailloux, to deposit any amount of copper with a given amount of electrolytic power. A preceding speaker mentioned the fact that in order to double the current density the power has to be quadrupled. Proceeding inversely, and decreasing the density, a point will finally be reached where, although very large deposits will be made with the given energy, the area of plant required and the interest costs on the large amount of copper tied up would prevent the economical use of any lower densities.

Mr. Addicks pointed out that the higher the current density the more rapid must be the circulation in order to keep sufficient copper close to the anode, which, he said, is the secret of making good deposits. He added that in one year's time a triple-compound engine consuming 15 lb. of steam per kw-hr. would show savings over a 1500-kw turbine consuming 17 lb. per kw-hr., amounting to $39.42, figuring steam at 15 cents per 1000 lb., or $2.60 per kw. Such a saving would justify the additional expenditure of $15 per kw on the plant. Mr. Addicks questioned whether a turbine, with its alternating-current generator, transformer, rotary-converter and booster, would be, after all, very much simpler than a reciprocating engine driving a direct-current generator.

Mr. Vom Baur spoke of the use of oil engines in the electrochemical industries. Oil from fields recently discovered in Mexico can be sold in New York, he said, for less than 3 cents a gallon, so that such engines can produce a kilowatt-hour for 0.45 cent.

Mr. Addicks in closing the discussion pointed out that the oil engine employs a fuel which, compared with coal, is in the hands of a small selling group, and he also questioned whether such internal-combustion engines have the reliability necessary for electrolytic work.

Mr. Longwell said that the gas engine has a great many uses to which it is eminently suited, but that he doubted whether electrolytic plants were included among these.

Mr. Newbury explained as the reason for selecting very large plants as examples his effort to show that in such sizes the converter apparatus recommended is really simpler, more reliable, more efficient and less costly to maintain than the apparently simpler installations consisting of merely prime mover and generator. In sizes of 1000 kw to 2000 kw, he admitted, the turbo-alternator and rotary-converter cannot make a showing against the direct-current generator provided the electrolytic plant is located near the place of generation.

Automobile Engineers Discuss Electrical Subjects

At the annual meeting of the Society of Automobile Engineers, held at New York City Jan. 4 to 8, standard dimensions and methods of rating lead storage batteries for gasoline cars were adopted, and several papers on electrical subjects were presented. Among the topics discussed were the following: "Storage Batteries," Mr. W. H. Conant, Gould Storage Battery Company, New York; "Development of Electric Tractors for Handling Freight Cars Over Tracks Laid on City Streets," Mr. T. V. Buckwalter, engineer Pennsylvania Railroad; "An Electrically Controlled Dynamometer for Testing Gas Engines," Prof. R. C. Carpenter and Mr. Nathan C. Johnson, Cornell University, Ithaca, N. Y., and "Shifting Gears by Electricity," Mr. Frank N. Nutt, chief engineer Haynes Automobile Company, Kokomo, Ind.

The practices recommended by the electrical equipment division of the organization were accepted as standard by the society. These rulings will affect many electrical manufacturers unless modified by the standards committee. The latter action may follow as the result of objections presented by the United States Lighting & Heating Company, New York, too late to affect the approval given by the society.

The recommended practices read as follows:

Six-volt to 25-volt automobile electrical apparatus after being installed shall be capable of withstanding an insulation test of 500-volt alternating-current applied for one minute.

The over-all dimensions of lead storage batteries for lighting and starting or a combination of the two shall not exceed 7.5 in. in width or 9.5 in. in height. Handles and clamping devices shall be placed only on the ends of the batteries, and terminals shall not extend above the battery handles.

Lighting batteries shall be rated in ampere-hours, figured on the 5-amp rate of discharge which terminates in a final voltage of 1.8 per cell. Combination lighting and starting batteries shall have two ratings—the one for lighting being expressed in ampere-hours figured on the 5-amp discharge rate with a final pressure of 1.8 volts per cell, and the second, for starting, being given as the maximum ampere rate at which the battery can be discharged for twenty minutes with a final pressure of 1.65 volts per cell. The initial temperature in each case shall be 80 deg. Fahr. The dimensions and type of fuses for automobile equipment were also specified.

Mr. Conant's paper on storage batteries described in a semi-elementary and technical manner the theory, construction and characteristics of lead storage batteries. Positive and negative voltage reading by means of a cadmium electrode was discussed by the author. Other subjects taken up in the papers dealt with efficiency, the relation of voltage and rating, and the effect of temperature on battery action.

The paper on electric tractors by Mr. Buckwalter had been previously read before the Chicago meeting of the Association of Railway Electrical Engineers and is briefly mentioned in the Nov. 1 issue of the *Electrical World*.

Mr. Johnson in his paper described an electrically controlled dynamometer used to record the torque of a gasoline engine and at the same time automatically maintain the speed of the engine constant. An abstract of this paper will appear in a later issue.

Equipment for shifting automobile transmission gears by means of solenoids was described in Mr. Nutt's paper. A lively discussion followed in which some of the advantages and disadvantages of the electric gear shifts now manufactured were brought out. The feasibility of further electrifying gasoline cars by installing electrical steering and braking apparatus was also discussed. Among those who expressed their views were Messrs. Findley D. Hubbell, Pope Manufacturing Company, Hartford, Conn.; George W. Dunham, Chalmers Motor Company, Detroit, Mich.; William Guy Wall, National Motor Vehicle Company, Indianapolis, Ind.; W. A. McCarrell, Vulcan Motor Devices Company, Philadelphia, Pa.; Howard Marmon, Nordyke & Marmon, Indianapolis, Ind.; B. B. Bachman, Autocar Company, Ardmore, Pa., and Herbert Chase, New York City.

Questions were raised as to the speed and practicability of changing gears electrically as compared with the manual operation.

Mr. Wall said that for the inexperienced motorist electric gear shifting is simpler than manual operation, while the experienced driver can acquire skill in operation with the modern method which makes it superior to hand control.

Mr. McCarrell pointed out the advantages of electric gear shifting: first, it is better suited to women motorists; second, the hands need never be removed from the steering wheel, and, third, every speed change can be anticipated. Further electrification of cars to cover steering and braking, the speaker declared, will require additional battery rating, which is not warranted.

Specification for Rubber Insulation

The joint rubber insulation committee, the activity of which was noted on page 828 of our issue dated Oct. 25, 1913, has published its report simultaneously in the January issues of the *Proceedings* of the American Institute of Electrical Engineers and the *Journal of Industrial and Engineering Chemistry*, the latter being the monthly publication of the American Chemical Society. The report will also appear in the next issue of the United States Bureau of Standards' circular on rubber. A specification for a high-grade rubber compound and details of an analytical procedure for use with it contained in the report are reproduced herein.

The industry is now provided with a specification prepared by a body of chemists and engineers, all actively engaged in the field of rubber insulation, composed of representatives of manufacturers, consumers and independent consultants in equal numbers. From the manufacturers' point of view this specification is of considerable economic importance as it gives them an opportunity to escape from the necessity of making a number of different 30 per cent Para compounds to meet the various specifications now in use. Manufacturers will now be required to make only three grades of rubber insulation, the Code, the Intermediate and the 30 per cent Hevea, although, of course, certain manufacturers will continue to make proprietary articles which cannot be purchased under specification.

The specification has been adopted by the Association of Railway Electrical Engineers, has been recommended for adoption by the committee on rubber-covered wire of the American Electric Railway Association, and is now in use by the electrical department of the New York Central & Hudson River Railroad Company. It is expected that other users of high-grade rubber insulation will adopt this specification and thereby do away with the host of existing specifications.

It will be noted that this specification must be supplemented by appropriate clauses relating to tensile strength, elasticity, insulation resistance and dielectric strength. The joint rubber insulation committee has made no effort to supply clauses containing these requirements, but other committees have made recommendations on these subjects, so that it is now possible to write a specification for high-grade rubber insulation complete in all respects.

Specification for 30 Per Cent Hevea Rubber Compound

1. A 30 per cent fine Para or smoked first-latex Hevea rubber compound with mineral base shall be furnished. It shall contain only the following ingredients: Rubber, sulphur, inorganic mineral matter and refined solid paraffine or ceresine.

2. It shall not contain either red lead or carbon.

3. The vulcanized compound shall conform to the following requirements when tested by the procedure of the joint rubber insulation committee: (See *Proceedings* A. I. E. E. and *Journal of Industrial and Engineering Chemistry*, January, 1914.)

(a) Results to be expressed as percentages by weight of the whole sample:

	Maximum	Minimum
Rubber	33	30
Waxy hydrocarbons	4	—
Free sulphur	0.7	—

(b) Results to be taken between the limits given in proportion to the percentage by weight of rubber found:

	Maximum	Minimum
Limits allowed for 30 per cent rubber compound:		
Saponifiable acetone extract	1.35	0.55
Unsaponifiable resins	0.45	—
Chloroform extract	0.90	—
Alcoholic potash extract	0.55	—
Total sulphur (see note 2)	2.10	—
Specific gravity	—	1.75
Limits allowed for 33 per cent rubber compound:		
Saponifiable acetone extract	1.50	0.60
Unsaponifiable resins	0.50	—
Chloroform extract	1.00	—
Alcoholic potash extract	0.60	—
Total sulphur (see note 2)	2.30	—
Specific gravity	—	1.67

4. The acetone solution shall not fluoresce.

5. The acetone extract (60 cc) shall be not darker than a light straw color.

6. Hydrocarbon shall be solid, waxy and not darker than a light brown.

7. Chloroform extract (60 cc) shall be not darker than a straw color.

8. Failure to meet any requirements of this specification will be considered sufficient cause for rejection.

9. Contamination of the compound, such as by the use of impregnated tapes, will not excuse the manufacturer from conforming to this specification.

Note 1: This specification shall be supplemented by appropriate clauses relating to tensile strength, elasticity, insulation resistance and dielectric strength.

Note 2: The limit in total sulphur may be omitted at the option of the purchaser. It would be desirable that the sulphur of vulcanization be limited to exclude reclaimed rubber, which contains the sulphur of its previous vulcanization, but the committee has not yet developed a method for determining this quantity. It is, therefore, confronted with the choice of either placing a limit on the total sulphur or giving up the attempt to exclude shoddy by sulphur limitation. Option is therefore given to the purchaser to insert or omit the limit on total sulphur. Such insertion will at times exclude reclaimed rubber, and the committee believes it possible to make a suitable compound with this limitation. The committee thinks that a sulphur limit posi-

tively excluding reclaimed rubbers would place too great a hardship in other ways on the manufacturers. Where the specification is used with no total sulphur limit, the use of many kinds of, or much, reclaimed rubber will be guarded against by the limits of the various components of the acetone extract. When the limitation on total sulphur is omitted, sulphur-bearing fillers, which possess certain advantages, may be used.

The Engineer's Part in Regulation

A discussion on "The Engineer's Part in the Regulation of Public Utilities" was held at the Stevens Institute of Technology, Hoboken, N. J., on Jan. 9. Those who took part in the discussion were Dr. Alexander C. Humphreys, president of the institute, and Messrs. John W. Lieb, Jr., James E. Sague, Newcomb Carlton and George Gibbs.

Dr. Humphreys Urges Engineer Commissioners

Dr. Humphreys cited cases where commissions exercised discrimination or rendered unfair decisions excluding testimony or affecting public service corporations. He holds that no commission or any other one government authority should be placed in office to exercise the three functions of government, legislative, executive and judicial. There should be some measure of control of public utilities, particularly if these properties are to be protected in monopoly. The general tendency of the public service commissions is to discourage destructive competition.

Those responsible to the owners must be permitted to manage the properties if efficiency and economy are to be obtained and maintained. Certainly the utilities should not be held to any cast-iron rule as to fair return when what would be a fair return in one case would be wholly inadequate in another case.

Dr. Humphreys pointed out that the state commissions need regulation as much as corporations. Too often the men appointed are not qualified to exercise the great power placed in their hands. The honest men among them recognize this and apply themselves diligently to fit themselves for the responsibilities for which they were not fitted when they assumed office.

Continuing, Dr. Humphreys said that many of the questions which the commissions are called upon to determine require for their solution the highest engineering training and experience, yet it is the exception when an engineer is appointed as a commissioner. The engineering profession is most often represented not by membership on the board but by employment by the board, and so with no vote. On every one of the commissions the engineering profession should be adequately represented in the persons of men educated in engineering and later trained in the hard school of experience.

Whether the commissioner is engineer, lawyer, accountant or business man, he should have had experience in the exercise of administrative functions. In character he should be above reproach. He should be judicial in temperament and particularly he should be free from the temptation of playing to the gallery. The engineers as a class are themselves in part to blame for not taking a more active part in the administrative side of life and for not deliberately and advisedly equipping themselves for administrative responsibilities.

In speaking of the predominance of lawyers on commissions, Dr. Humphreys said that if the membership of the commission must be consigned to a single profession five broadly trained engineers with competent legal assistants on the staff would give far better results than have, on the average, been obtained thus far.

In conclusion, Dr. Humphreys emphasized the point that as a general proposition the great corporations have not won their success by financial legerdemain. The pioneer labors have been for the benefit of the country as a whole, and therefore it ill becomes the representatives of the people to deny to these pioneers and their successors a rightful participation in the fruits of their successes. The legislation and regulation which in the final analysis will stand the test of time and will accord justice to the producer and the consumer must take full account of the inherent physical and financial limitations within which the properties are forced to operate.

Mr. Carlton Favors Engineers as Commissioners

Following the reading of Dr. Humphreys' paper, Mr. Newcomb Carlton, vice-president of the Western Union Telegraph Company, called attention to two points: The personnel of public service commissions in general is far from satisfactory. The commissions would be made more equitable, judicial and competent by the appointment of mechanically trained, experienced engineers as members. Mr. Carlton declared that he could not conceive of an engineer capable of fulfilling all the requirements suggested by Dr. Humphreys. An engineer possessing sound technical knowledge coupled with broad administrative experience is in demand everywhere and is therefore placed beyond the call of commissions as now constituted, unless patriotism is a controlling motive.

Regulation has come to stay and commissions should therefore be organized so as to become attractive to men of the caliber desired. Because of the threefold functions of a commission (legislative, executive and judicial) this body should be advanced to the permanent standard of a court with the corresponding respect, honor and dignity that attaches to a judicial body. By educating the public to hold the opinion that public service control must succeed and can succeed only through its exercise of fairness and broadmindedness, the equitable consideration of all can be obtained.

Mr. Gibbs on Commission Organization

A paper by Mr. George Gibbs, consulting engineer of the Pennsylvania Railroad, was read by Dr. Humphreys.

Mr. Gibbs said that an engineer in the position of business manager or commissioner on a public utility board soon, on account of his multifarious duties, gets out of touch with the details of professional progress, and unless he is willing to delegate the investigation of engineering matters to subordinates who are specialists, his decisions must rest upon general knowledge, which is not always a true guide. The matter of proper commission organization is fundamentally one of selecting faithful men of sound judgment and organizing ability, previous specialized training being a matter of less importance. Another consideration of very great importance in commission organization is that of the proper term of office. If the selection of commissioners is of the character mentioned, a long office tenure would be to the great advantage of the community, and it seems a great pity that frequent changes at short intervals, which are now the rule, should deprive the public and the corporations of the benefit of the commissioners' experience acquired while holding office.

In the opinion of Mr. Gibbs, the internal organization should include a permanent engineering staff headed by a chief engineer of eminence in his profession and the retention of outside engineering consultants who are specialists in the various lines of engineering advice needed and who are called in as occa-

sion requires. This organization, of course, presupposes that the engineering staff will be called upon for analysis of the technical problems arising before the commission and that the latter will accept the advice of its staff upon such matters.

Mr. Gibbs believes, from personal experience on both sides of the railway-regulation question, that a good start has been made in working out the complex problem upon these lines. The commissions have very important and useful functions to perform and are becoming increasingly solicitous of performing their duties well. The railroads, on their part, believe in thorough and impartial investigation of matters affecting the public interest and are co-operating with the commissions. The engineer has an important status in connection with the commission work, and, as a matter of fact, this is so well recognized that staff engineers are frequently more highly paid men than the commissioners themselves. The added honor of holding the title of "commissioner" is, of course, attractive, but is not essential to the dignity of the engineering profession, nor will the field opened up by the employment of a few engineer commissioners add materially to the opportunities of men of that profession in securing positions of high honor and remuneration in the community.

Mr. Lieb Sees Need of Lawyers and Engineers

Mr. John W. Lieb, Jr., vice-president New York Edison Company, said that it must be obvious that the presence of a technically educated and scientifically trained member on the commission should be of enormous assistance and value in its work, only second in importance to the presence of a representative of the legal profession. The professional politician is likely to be strongly represented in the make-up of the commissions, but to find a representative of the engineering profession in the commissioner's chair is indeed unusual and exceptional. This cannot be in the public interest and shows a state of things which does not reflect wisdom and foresight in the appointive or elective powers and is hardly creditable to the authority and influence of the engineering profession in the conduct of public affairs.

Surveying the field from the viewpoint of those who have had to represent the interests of the corporations subject to the jurisdiction of the commissions, Mr. Lieb said that it is a matter of surprise that the commissions have done as well as they have in many cases which have come before them involving purely technical or engineering matters.

In the treatment of rate questions—in addition to the commanding questions of company policy and commercial expediency—the factors which enter into the problem are largely engineering questions, Mr. Lieb said, and their determination must depend upon engineering knowledge and experience. These questions involve consideration of such matters as physical valuation, functional depreciation, normal wear and tear, obsolescence, supersession, adequacy of equipment, betterments, etc., all of which are matters that must be approached from the engineer standpoint, and their proper evaluation must devolve upon the engineering staff. On the other hand, such matters as the ultimate property value for rate-making purposes, the rate of return, going-concern value and the building of the rate structure are matters which require something more than engineering judgment, knowledge and experience for their determination.

Continuing, Mr. Lieb said that many of the questions involved in commission regulation are the results of operation of economic laws, the laws of supply and demand, of economic production and distribution, of marginal utility, etc. The consolidation of small plants into large production units to obtain the results of large bulk output, lower investment costs, higher operating efficiencies, improved load-factors and combined diversity factors—this is a question in engineering economics and the efficient conduct of business which has developed new problems in the operation of public service corporations, and with these the commissions must also concern themselves. Public opinion has expressed itself as opposed to that monopoly which aims to crush competition, but it fails to make delicate distinctions as to whether the monopoly ensues naturally and logically upon the combination, as a result of improvements in operating efficiencies incidental to the consolidation of production and distribution facilities, or as a result of a mere conspiracy to "freeze out" a struggling competitor.

Mr. Sague on Experiences in New York

The final discussion was presented by Mr. James E. Sague, member of the Public Service Commission of the Second District of New York. He joined in the expressions of the other speakers preceding him by remarking that it is peculiar that engineers should have taken so little interest heretofore in a state regulation which affects the business success of practically all engineers. Mr. Sague believed that legislation involving details of operation in public utilities should be a matter of last resort. An increased demand for public ownership can be expected unless regulation is made so efficient and just as to satisfy reasonably the public need. At the same time, it is necessary to preserve to public utility managers their right to enthusiastic and successful work and to the stockholders their just return. Commission regulation is still in the "stone age" of its development. There is no precedent to guide the governors in their appointments, or the commissioners in the exercise of their duties. Lawyers can afford to accept commission appointments better than can engineers of equal grade, as the work does not seriously interrupt their legal career and may be a decided help.

In conclusion, Mr. Sague said that it is the right and duty of engineers to take part in the solution of these great problems. They can be settled properly only after the truth has been ascertained, and a fundamental duty of engineering is to ascertain the truth and to work in accordance with it.

Convention of Independent Telephone Association of America

The Independent Telephone Association of America met at the Hotel LaSalle, Chicago, on Jan. 6, 7 and 8 for its first annual convention.

In response to an address of welcome by Mr. L. D. Mathias, of the office of the Corporation Counsel, city of Chicago, Mr. D. M. Neill, Red Wing, Minn., said that the independent telephone men wondered at the passive attitude with which the people of Chicago accepted the telephone monopoly when they had been so progressive in disapproving all other restrictive business combinations. He said that although utilities commissions in many states had the power to regulate the income or dividend earnings of a company, they were powerless to fix expenses of the companies or to adjust salaries of officers. Competition, he stated, was the only real correction.

In his presidential address Mr. E. B. Fisher, Grand Rapids, Mich., declared that the independent telephone men are firm believers in the value of competition for bringing about the most efficient service. He said that

telephone companies should not be allowed to violate anti-trust laws any more than should other corporations. Mr. Fisher declared that monopolistic interests had withheld telephone patents from the public which should be used for the betterment of the industry. Quoting from a statement by President Wilson on anti-trust legislation, he stated that certainly in that policy the President of the United States has the hearty support of the convention. He suggested that the association through committees keep the Department of Justice informed as to the views of its members on questions of telephone monopoly in various parts of the country.

At the afternoon session Mr. J. B. Middleton, Portland, Ore., read a letter from Mr. Samuel Hill, president of the Portland company, urging the co-operation of the independent companies and suggesting that they might act with the Postal Telegraph-Cable Company as the Bell companies co-operate with the Western Union Telegraph Company.

Speaking on liability insurance and the workman's compensation act, Mr. W. A. Alexander, Chicago, explained state laws as they affect telephone companies in their relations with the public, showing how employers may insure themselves against loss through injury to employees. To show that telephone companies need such insurance he made the statement that during the last year 25,000 telephone men had been injured and 123 men had lost their lives. During the same period 183 employees of electric-lighting companies were killed in accidents, according to Mr. Alexander. It will be found, said the speaker, that in cases where crossed wires of telephone and electric-lighting companies are the causes of accidents the decisions are about equally divided as to which company is at fault. Judgment is generally rendered against the company owning the defective wire

Alderman C. E. Merriam, Chicago, deplored the Chicago City Council's loss of power with the coming of the State Public Utility Commission of Illinois, stating that corporations might be able to obscure local issues in the excitement of a state or nation-wide election. The present choice of corporations, said the speaker, lies between thorough-going and stringent regulation and government ownership, and the responsibility of managers and operators of utilities to their shareholders is heavy. Only by giving the best service can the issue of government ownership be avoided.

The Independent Telephone Association of America has been formed, said Mr. C. B. Randall, St. Paul, for telephone men who wish to stay in the business and not for promoters. The speaker outlined briefly the qualifications for membership, stating that only telephone companies in which the American Telephone & Telegraph Company does not hold a substantial financial interest are eligible.

For the reason that 80 per cent of the toll calls of this country are conducted within a 30-mile radius and 10 per cent of the calls do not extend over distances of more than 150 miles, Mr. Randall contended that the toll business of the country as well as the local exchanges could be handled without use of the Bell lines, especially at the prices now offered by Bell interests.

Mr. J. C. Crowley, Jr., Superior, Wis., said in discussing the future work of the service committee that the aim would be to print each month in the bulletin of the association accounts of solutions of common problems of benefit to operators of small exchanges. The articles will contain data on erection and maintenance of indoor and outdoor plants.

In a paper entitled "An Accounting System Which is Simple, Flexible, Practical and Meets the Requirements of State and National Commissions," Mr. J. W. Coffey, Indianapolis, Ind., explained how the accounts of companies should be conducted in order to facilitate making out reports for the state commissions.

In the Wednesday afternoon session Mr. J. C. McCabe, Bay City, Mich., who has been a newspaper publisher for many years but is now interested in the telephone company in Bay City and Saginaw, read a paper entitled "Publicity." It was shown that newspaper advertising is desirable for the telephone company making a campaign for new subscribers. Sample advertisements which had been used in Bay City were shown. Mr. McCabe said that managers of companies should cultivate the acquaintance of the newspaper men in their towns, and where the size of the company permitted, it was, in his judgment, good policy to maintain a publicity department.

At the "experience meeting" a resolution was introduced by Mr. Frank Binkley, of the Hamilton (Ohio) Home Telephone Company, proposing that the association aid the Hamilton company in its controversy with the American Telephone & Telegraph Company. The Ohio courts had decided that the subscribers of the Hamilton company are not entitled to the use of the Bell lines between Hamilton and Cincinnati, a distance of about 25 miles. The case is still before the courts and the commission. The resolution was referred to the resolutions committee and was adopted.

Speaking on "The Little Big Things of Transmission," Mr. H. T. Currier, Chicago, urged that standard apparatus be adopted for long-distance transmission. It is in this branch of the business, he pointed out, that individual companies have always been weak.

Mr. J. C. Crowley, Jr., Superior, Wis., in opening the discussion on the "Action of Wisconsin Railroad Commission on Standardization of Operating Rules and Practices," told of the steps taken by the Wisconsin State Telephone Association. Mr. J. N. Canby, of the engineering staff of the commission, read fourteen rules which had been formulated by the commission. A final hearing for revision and acceptance of the rules has been announced by the commission for Feb. 11 and 12, 1914.

Speaking on the financing of an independent telephone company, Mr. W. F. Goodrich, LaCrosse, Wis., outlined his ideas as to the best means of raising capital.

At the Thursday morning session short illustrated talks were given by Mr. Arthur Bessey Smith, Automatic Electric Company, Chicago; Mr. E. C. Lewis, North Electric Company, Galion, Ohio; Mr. H. N. Farris, Kellogg Switchboard & Supply Company, Chicago, and Mr. H. N. Tolles, Sheldon School of Salesmanship, Chicago. Mr. W. N. Matthews, present Jupiter of the Jovian Order, also gave a short talk.

On Thursday afternoon the committee on resolutions, of which Mr. B. G. Hubbell, Buffalo, was chairman, presented a number of resolutions which were accepted as read. The resolutions are briefly as follows: (1) Resolved, that the Bell interests be enjoined from monopolizing interstate telephone business; (2) that the American Telephone & Telegraph lines be declared common carriers; (3) that the acquisition by the Bell interests of properties which still remain physically separate and intact be declared invalid; (4) that aid be given authorities in regulation for securing the above results; (5) that the Western Electric Company be enjoined from further purchase of telephone manufacturing plants. Officers of the society have been instructed to take necessary steps for the carrying out of the resolutions.

On Wednesday evening about 350 members and guests

attended a dinner at the Hotel LaSalle. The election of officers resulted as follows: President, Mr. B. G. Hubbell, of the Federal Telephone & Telegraph Company, Buffalo, N. Y.; first vice-president, Mr. E. B. Fisher, Grand Rapids, Mich.; second vice-president, Mr. E. D. Shade, Johnstown, Pa.; treasurer, Mr. Richard Valentine, Janesville, Wis.; secretary, Mr. W. S. Vivian, Chicago.

Meeting of National Independent Telephone Association

The National Independent Telephone Association opened its seventeenth annual convention at the Hotel LaSalle, Chicago, on Jan. 13. At the opening session ex-Congressman J. Adam Bede, of St. Paul, Minn., made an address on "The Solutions of America's Problems."

Mr. Richard Yates, a member of the Illinois Public Utilities Commission, outlined the non-partisan policy of that body and stated that thus far the utilities of the State had evinced no anxiety regarding the adjustments to be made by the commission. Comparing the New York commissions' duties with those of the Illinois body, he said that while New York State outside of New York City had 902 utilities within its jurisdiction, the number in Illinois totaled 2973. Discussing the needed amendments to the income tax law, Mr. William Fortune, of Indianapolis, Ind., stated that, although he in no way opposed the principle of the income tax, he would strongly suggest that deduction at the source be abolished and information at the source be substituted. This amendment, he said, would allay much of the existing confusion.

Public Service Commission News

District of Columbia Commission

The Public Utilities Commission of the District of Columbia has denied the petition of the Chesapeake & Potomac Telephone Company, a New York corporation, for authority to invest $140,000 of its sinking funds in bonds of the Chesapeake & Potomac Telephone Company, a Virginia corporation. The reason for the denial is that the petitioner owns all of the stock of the Virginia corporation, and it is the judgment of the commission that permission to make such an investment under such circumstances should not be granted in view of the design and purpose of the public utility and anti-merger laws of the District of Columbia.

Wisconsin Commission

A new departure in public utility regulation is evidenced by the recent action of the engineering department in assuming temporary management of the Neshonoc Light & Power Company's business for the purpose of demonstrating to the management that the business could be sufficiently developed to warrant the introduction of day service and to make the improvements necessary to render more adequate service. The utility has in the past refused to make the improvements in its service as recommended by the commission on the ground that the amount of business to be gained would not justify the expense necessary. The commission's engineers during their short stay at the plant solicited enough power business to make the service profitable within a short time after its establishment. As a result of this investigation, the utility will be ordered to rehabilitate completely its hydroelectric plant and to add such new equipment as may be specified by the commission.

Massachusets Commission

The Massachusetts Board of Gas and Electric Light Commissioners has filed its annual report with the Legislature, which convened on Jan. 9. The most important recommendation for new legislation is that the decision of the commission be made final in respect to security issues. The board says:

"During the last year the Supreme Court of the Commonwealth rendered an important decision concerning the authority of the board respecting approval of issues of capital stock. This case (Fall River Gas Works Company versus Gas and Electric Light Commissioners) was a petition for a writ of certiorari on account of a decision of the board dismissing an application for approval of new stock, for the purpose of annulling that decision, and the court directed the writ to issue.

"The result of this court decision has been to call in question some of the most important and fundamental principles underlying the policy so long and consistently pursued in this commonwealth for regulating and controlling companies of this character, a policy which has influenced all of the legislation relative to these companies and antedates the creation of this board. The so-called anti-stock watering legislation of 1894 was intended to give this policy a more positive expression and application rather than to alter or restrict it. Its purpose has been to limit the issue of securities of public service companies exercising a virtual monopoly to their actual needs and to prohibit the representation in additional securities of surplus earnings invested in the plant, with the important object of keeping at a reasonable minimum the dividend burden to be borne by the public.

"The entire course of legislation clearly indicates the well-founded conviction that the volume of securities outstanding against any public utility has a potent effect upon both rates and quality of service, since prices are made and maintained to meet expectations of stockholders as to dividends and service may be seriously impaired by a continued endeavor to meet those expectations. The language employed by the court is so broad that, notwithstanding the narrow issue which was actually involved, it has been made the basis for a claim that the only function of the board is to determine whether the amount of money to be raised is necessary for the particular work done or to be done, and from that the amount of securities necessary.

"It is even confidently asserted that all expenditures for new property must, if the company requests, be represented in new securities regardless of the fact that no obligations may be then outstanding on account of such expenditures or of the company's condition at the time when the board's approval is sought. Under these claims no question of legality of the issue proposed or of the existence of other resources ample to meet the cost of proposed work, no general question of public policy or public interest involved, can be considered by the board.

"If such construction be correct, it is in direct conflict with the policy above described, seriously impairs, perhaps wholly destroys, the effectiveness of a long line of legislation and subverts administrative methods pursued by this board without serious challenge for more than twenty years. The board is of the opinion that the construction referred to is an erroneous one and that the court did not intend so far to weaken the effect of existing law.

"It should be possible to express legislative purposes so clearly as to avoid future disputes. This may well be done by somewhat enlarging, or perhaps more clearly defining, the board's discretion respecting approval of stock and bond issues."

Current News Notes

Cost of Motor Drive.—On page 381 of our issue dated Aug. 23, 1913, appeared an article entitled "Investigation of the Cost of Motor Drive in a Six-Story Factory." Credit should have been given in this article to Messrs. Royal M. Barton and Frank C. Taylor, of the class of 1911, Massachusetts Institute of Technology, who compiled the data therein shown for a graduation thesis, an abstract of which formed the basis of the article published.

* * *

Special Trains to Philadelphia Convention, N. E. L. A.—At a meeting of the transportation committee of the National Electric Light Association held at Philadelphia, Jan. 8, to discuss transportation plans for the N. E. L. A. convention scheduled for that city in June, Mr. George W. Elliott, New York, chairman of the committee, announced that a rate of 2 cents per mile had been granted by the Trunk Line Association for the use of delegates to the convention, and that the same rate would probably be followed by other traffic associations throughout the country. Because of the short distance and frequent regular train service to Philadelphia, special trains are not planned from New York City or New England points. From Chicago special trains will be run over the Pennsylvania and New York Central railroads, and it is also planned to have specials from St. Louis and the South.

* * *

Energy Consumption and Cost of Vehicle Operation.—At an educational meeting held in the auditorium of the Public Service Building, Jersey City, N. J., the subject of motor vehicles was discussed by Mr. S. C. Thompson, of the Public Service Company of New Jersey. After showing figures to prove that the electric truck costs less to operate than either horse-drawn or gasoline vehicles, results of an actual test were presented comparing the performance of a gasoline truck and an electric truck over forty-eight months' operation. In this case the cost of maintenance was found to be 18.5 cents per mile for the gasoline truck and only 8.5 cents per mile for the electric truck. Diagrams showing the relative amounts of energy consumed by different types of tires and street surfaces also proved very interesting. It was seen, for example, that a motor vehicle running on asphalt had an energy consumption of 1 kw-hr. per mile while the same car running through soft snow consumed 2.06 kw-hr. per mile.

* * *

SOCIETY MEETINGS

Supply Jobbers to Meet.—The Electrical Supply Jobbers' Association will hold its next convention at the Raleigh, Washington, D. C., from Feb. 17 to 19, 1914. Mr. Franklin Overbagh, 411 South Clinton Stret, Chicago, Ill., is the general secretary.

* * *

Annual Meeting of Pittsburgh Electric Association.—At the annual meeting of the Pittsburgh Electric Association held on Jan. 3 the following officers were elected: President, Mr. A. G. Pierce; first vice-president, Mr. J. W. Smythe; second vice-president, Mr. D. P. Lockard; secretary, Mr. J. A. Jaques; treasurer, Mr. O. J. Goettman, and trustees, Messrs. L. J. Kiefer and A. A. Anderson.

* * *

Meeting of Jovian Electrical League of Southern California.—The regular weekly meeting of the Jovian Electrical League of Southern California was held at Christopher's, Los Angeles, Jan. 7. Mr. Lissner delivered a very interesting address illustrated with stereopticon pictures, the subject being "Camera 'Flashes' During a 'Short Circuit' of Europe." Mr. Max Lowenthal presided. A rejuvenation will be held Feb. 6.

* * *

Yonkers Division, N. E. L. A.—At the monthly meeting of the Yonkers (N. Y.) Division, N. E. L. A., Jan. 12, Mr. L. W. Johnson presented a paper entitled "The Inspector in His District," Mr. A. A. Chisholm discussed "Service Connections," and Mr. A. W. Slocomb read a paper on "Ohm's Law," which was illustrated with lantern slides. Mr. Max Cohen, assistant corporation counsel, followed with an address on "City Government."

* * *

Chicago Jovian League.—At the luncheon of the Chicago Jovian League on Jan. 12, Mr. E. N. Lake, of the Stone & Webster Engineering Corporation, gave an illustrated talk showing some recent examples of engineering and construction practice. One interesting statement made was that the concrete-pouring equipment used in the construction of the Keokuk Dam was large enough to pour a structure equivalent to the Bunker Hill Monument in seventen hours.

* * *

Electric Club Luncheons in Kansas City.—Luncheons of the Electric Club of Kansas City, which are held bi-weekly at the Hotel Baltimore, have been well attended throughout the fall and winter months. At the meeting held on Dec. 23 the seventy-five members present listened to a short and interesting talk on advertising by Mr. Henry Schott, president of the Ferry-Hanly-Schott Advertising Company. Following Mr. Schott's talk, Mr. L. C. Spake, of the *Electrical World*, made a few remarks on the value of advertising as an educational force.

* * *

Philadelphia Section, E. V. A.—The Philadelphia Section of the Electric Vehicle Association of America was inaugurated with a meeting at the Franklin Institute, Philadelphia, Jan. 14. President Frank W. Smith, New York, was present and told of the work of the national organization, which now has a total membership of 542 divided as follows: Central stations, 70; manufacturers, 35; auxiliary, 9; associate, 400, and press, 28. Incorporated in 1910 with thirty-one charter members, the association's membership at the times of its annual conventions has increased as follows: First, 120; second, 197; third, 317, and fourth, 439. Within the year it is expected to increase the enrolment to 1000. Of the association's electric vehicle booklets recently issued, 10,000 copies have already been sold, and nearly 1000 inquiries have been referred to members.

* * *

Western Society of Engineers.—Officers of the Western Society of Engineers, of Chicago, have been elected for 1914 as follows: President, Mr. E. H. Lee; vice-presidents, Messrs. B. E. Grant, Ernest McCullough and G. F. Gebhardt; treasurer, Mr. C. R. Dart. The trustees consist of Messrs J. G. Giaver, F. E. Davidson and H. S. Baker. The board of direction is made up of the gentlemen named and Messrs. O. P. Chamberlain, W. C. Armstrong and Albert Reichmann, past-presidents. Mr. J. H. Warder is secretary. The annual meeting and dinner of the society was held on Jan. 7. Dr. Edwin H. Lewis was toastmaster, and Dean Mortimer E. Cooley of the University of Michigan read a paper on "The Relation of the Public and the Public Service Corporations." There were addresses by Mr. Reichmann, the retiring president, and Mr. Lee, the new president. At a meeting of the hydraulic, sanitary and municipal section of the society to be held on Jan. 19 Mr. John W. Alvord will present an address on "The Engineering Lessons from the Ohio Floods."

Electric Service in the Upper Peninsula of Michigan

Development of the properties of the Menominee & Marinette Light & Traction Company during the last twenty-five years —Hydroelectric plant, transmission and distribution systems

TRACING the "family tree" of a present-day electric-service organization in the average American city is an interesting occupation. In nearly every case the history of the art is, in a measure, mirrored by the growth, changes, consolidations and commercial history of the central-station companies. In the case of the Menominee (Mich.) and Marinette (Wis.) Light & Traction Company, whose modern physical equipment is described in the main portion of this article, it will be of interest to devote a few prefatory words to this historical development.

Nearly twenty years ago, with the formation of the Menominee Electric Light Company, capitalized at $28,000, a conservative policy in financial matters was adopted, and throughout the history of the organization this stand has been maintained. Since then other public-service companies in Menominee have been organized, operated independently for a while and later reorganized with increased capitalization, until at present all have been consolidated and are being operated as the Menominee & Marinette Light & Traction Company.

Historical Development

Referring to the "family tree" of the present company, it will be seen that originally four companies operated in the Menominee district, namely, the Menominee Electric Light Company, the Menominee Electric Railway & Power Company, the Menominee Gas, Light & Fuel Company and the Marinette Lighting Company. Subsequently, each of these companies was reorganized for reasons stated in the chart, and the number was reduced to three corporations, known as the Menominee Electric Light, Railway & Power Company. In nearly all of these instances it was necessary to have special acts passed by the legislatures of Michigan and Wisconsin permitting the reorganizations. Finally, on July 8, 1903, the three companies then existing were consolidated by agreement under the name which they now bear, the Menominee & Marinette Light & Traction Company.

Tracing the financial history of what is known as the parent organization, the Menominee Electric Light Company, capitalized originally at $28,000, it will be noted that upon the consolidation with the Menominee Electric Railway & Power Company in 1892 $58,000 in bonds was issued, and the amount of capital stock was raised to $110,000. When the final consolidation was effected in 1903 the company was capitalized at $560,000, which was increased to $1,000,000 when the new Rapids power plant was built on the Menominee River. For this project $355,000 in bonds was issued. It will be seen that a careful effort has been taken to

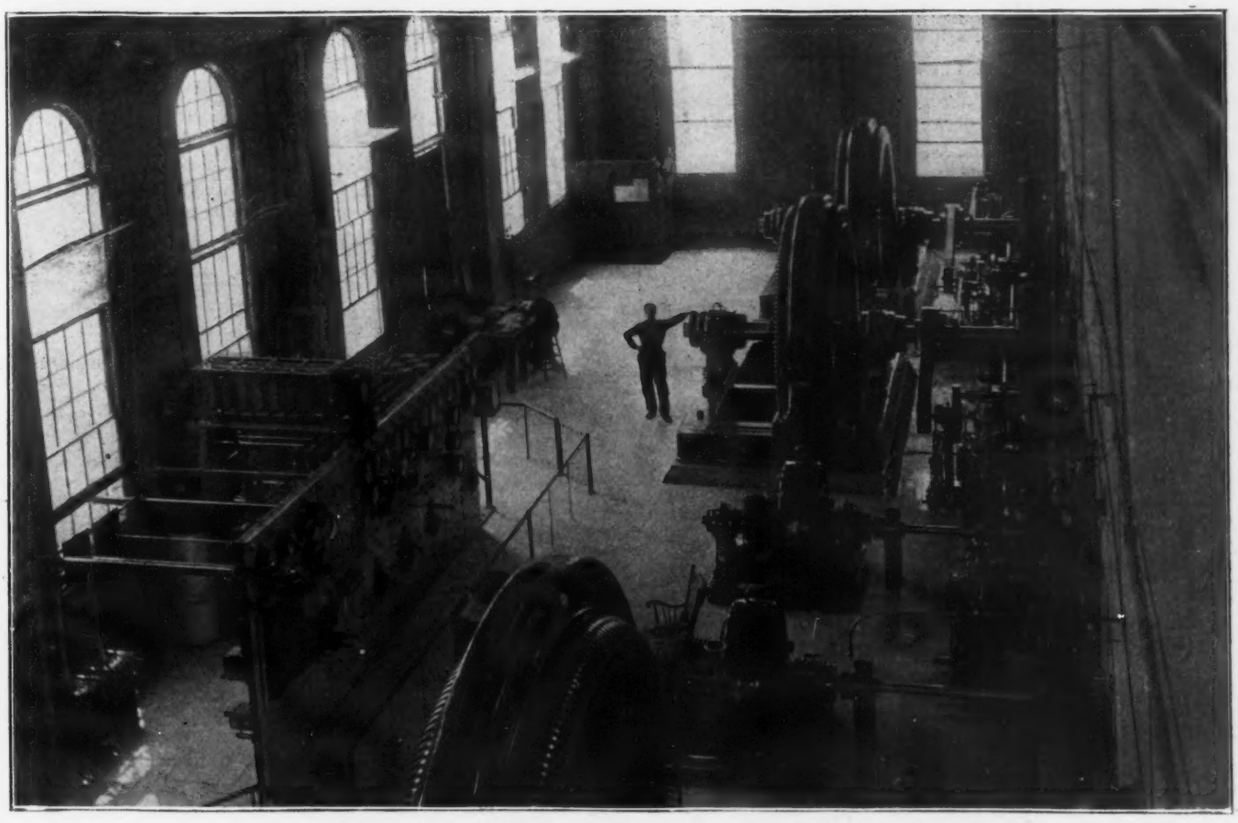


FIG. 1—INTERIOR OF RAPIDS POWER PLANT NEAR MENOMINEE, MICH.

keep down the bonded indebtedness. When $58,000 was needed, as was the case in 1892, the issue was made $58,000, and not $60,000 or $75,000 as a round figure. Again, every dollar received at the treasury of the company from the sale of bonds was always available for expenditure on the project in hand. Every bond of each issue by the parent companies has been

FIG. 2—SPILLWAY, TAINTER GATES AND LOG FLUME

sold at par to the companies' shareholders, without incurring the aditional expense of commissions paid to brokerage companies for selling the bonds. It is through such loyalty on the part of shareholders and through similar strokes of good management that the organization finds its stock free from over-capitalization.

The loyalty of the shareholders has not been without reward, however, for although the gas and street-railway properties have continued to earn about the same amount annually, the receipts from lighting and motor service have grown steadily year after year.

A New Plant and an Old One

The generating equipment of the present company consists of a hydroelectric station, known as the Rapids

FIG. 3—THE COMPLETED INTAKE CANAL

power plant, 20 miles above Menominee on the Menominee River, and a steam reserve station in the city. As a study in the evolution of generating and switching equipment during the past twenty years, the steam station is of unusual interest, for in it are to be found machines of all types from the early Edison bipolar generators to rather modern three-phase rotating-field alternators. All units are small, however, and the total rating of the plant's three reciprocating engines is but 1100 hp. These engines are all belted to a single-line shaft approximately 125 ft. long, and from this shaft the generating units are driven.

A portion of the building which houses this steam station constituted the original Menominee power house and still retains a few panels of an early pattern of wooden-front switchboard, representing the first step in removing switching apparatus from the station walls. These boards are now preserved as relics, having long since been discontinued from actual service. Very little switching and metering apparatus is installed in this plant, as its machines deliver energy directly to the Menominee substation near by. Although much of the equipment in the station is now out of date, in times of emergency this plant carries the railway and industrial load until relieved by the hydraulic station.

Hydroelectric Development

The site on which the company's hydroelectric power station now stands lies 20 miles north of the city of

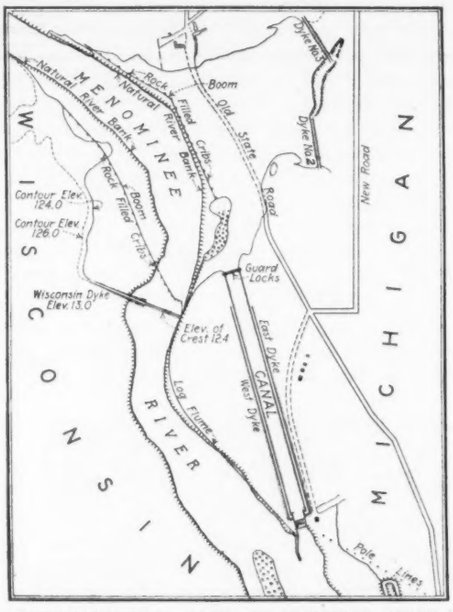


FIG. 4—TOPOGRAPHICAL MAP OF COUNTRY NEAR HYDROELECTRIC PLANT

Menominee on the Menominee River, the nearest railroad station being Ingalls, 2.5 miles to the northeast. Formerly there were rapids at this point, the river having some 26-ft. fall within a distance of 3400 ft. From the map in Fig. 4, showing the country about the site of the power station, it will be seen that the 3400-ft. canal dredged from a point above the rapids to their lowest extremity makes available this 26-ft. head at the head-works of the station.

Inasmuch as all construction had to be carried on at a distance of 2.5 miles from the nearest railroad station, transportation turned out to be an important factor in building the plant. First among the difficulties encountered was the transfer of two steam shovels from their flat cars to the canal over the country roads. By fitting up two small sections of track in which the ties and rails were firmly bound together, the feat, however, was accomplished. As the excavators advanced to the end of one piece of track, the shovel beams, managed by the engineer in charge, reached back, picked up the piece of track in the rear, and set it ahead of the locomotive excavator. Helpers aligned the track, and the locomotive then moved ahead under its own power

to the next piece of track and repeated the operation. The scheme was found satisfactory, and, except for an accident at a sharp turn in the road where one crane toppled over and fell down a steep embankment, the trips of both units were uneventful. Very litle damage was done to the shovel which tipped over, and in less than half a day's time the force of men had put it back on its wheels and it had again resumed its travel.

Inasmuch as the canal to be constructed measured 3400 ft. in length and 230 ft. in breadth and was 24 ft. deep at its lower end, the steam shovels played a very important part in the erection of the hydraulic works of the station.

All heavy castings and large electrical units for the plant were hauled by means of horses and double wagons from the railway station at Ingalls. It has been said authoritatively that money would have been saved in the erection of this power station had a spur railroad track been built at the outset for the transportation of machinery and materials.

Characteristics of Water-Power Plant

The erection of the dam across the river at the upper end of the rapids was no small undertaking. The Tainter gates and spillway measure 500 ft. and connect on the Wisconsin side with a 950-ft. earth fill or wing dam which stands about 6 ft. above the spillway. All of the concrete for the dam and Tainter-gate supports was mixed on the Michigan side of the river, and the easterly half of the dam was completed above the water level before work on the second half of the cofferdam was begun. Thus concrete for the second half of the dam was transported over the half which had been already built. The eight Tainter gates shown at the end of the dam adjacent to the Michigan shore have 8-ft. by 12-ft. openings and are raised by means of a motor-driven traveling hoist.

Dikes constructed in the various lowlands shut off the flood of impounded water from the marshes. All these dikes have a top elevation of 6 ft. above the spillway crest. Solid lines in Fig. 4 mark the areas submerged by the impounded water and the dotted lines show the extent of the pondage area when the dam is flashboarded to an additional height of 2 ft. The farm buildings grouped about the junction of the old state road (which has been submerged), with the private

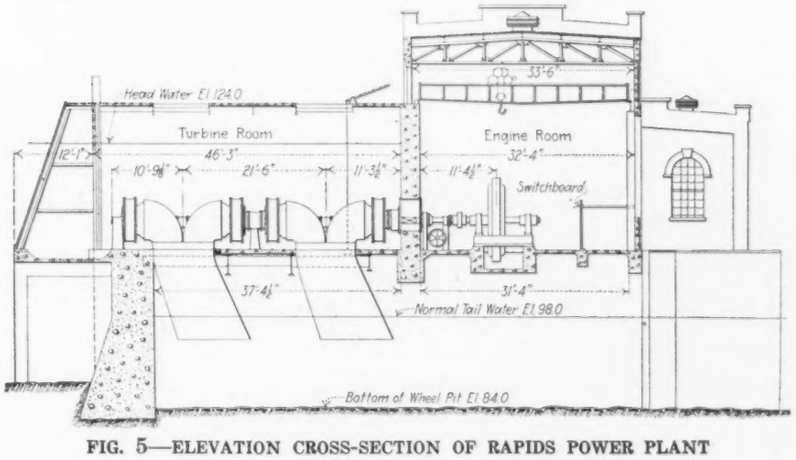


FIG. 5—ELEVATION CROSS-SECTION OF RAPIDS POWER PLANT

roads leading to Ingalls, are on the property of the Menominee & Marinette Traction & Light Company, the buildings having been purchased as part of the 1600-acre farm acquired by the company in securing pondage rights. The company also owns five modern dwellings just east of the central portion of the canal in which the station operators and their families live.

Each winter before the erection of the dam at the present site log jams used to form in the rapids on the river, requiring the services of several hundred men and the use of many hundred pounds of dynamite before the jams could be broken.

State laws in Wisconsin forbid water-power companies to impede the passage of logs, and hence a log

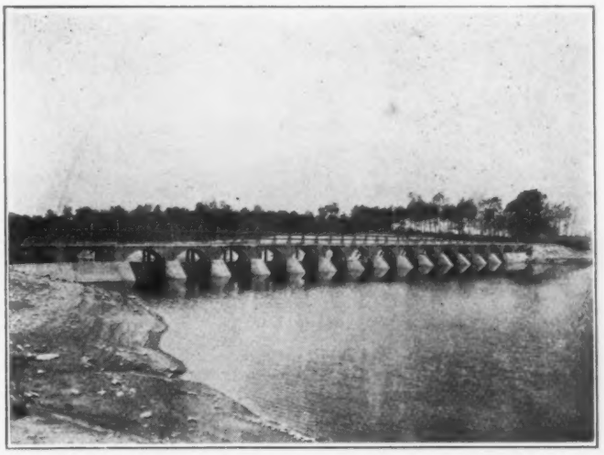


FIG. 6—GUARD LOCKS AT HEAD OF INTAKE CANAL

flume had to be built from the pond to the tailrace below the power house, a distance of 3200 ft. During the logging season several employees at the power house are kept at work sluicing the logs and keeping them clear of the spillway, brooms being used to divert the logs toward the mouth of the flume. In this way the company is able to save a considerable quantity of water, as it is not obliged to release water in large quantities through the Tainter gates to float the logs off the rapids below the dam. Incidentally the logging companies are spared no inconsiderable expense as log jams are avoided. The foundation framework of the log flume may be seen at the right in Fig. 2.

General Arrangement of Rapids Power Plant

The power house itself is constructed of monolithic concrete pillars and concrete blocks. As will be seen from Fig. 5, which is a cross-sectional drawing of the power house, both the trash rack and the open flumes above the wheels are virtually set in the extended bed of the canal, the tailrace extending under the power house and transformer room. The 3-ft. solid-concrete bulkhead wall on the up-stream side of the generator room withstands the pressure of the 26-ft. head of water in the canal.

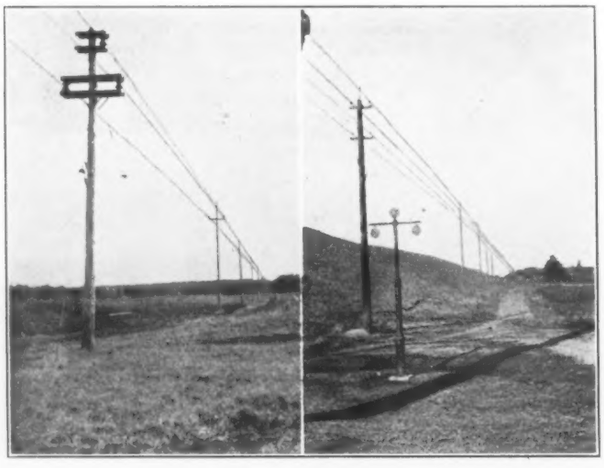
The alternating-current generating equipment of the station consists of two 100-kw, three-phase, sixty-cycle Westinghouse alternators driven by four 52-in. Dayton globe waterwheels operating in the open flume under a 26-ft. normal head. The nominal rating of each of these sets of wheels is 1900 hp. A third 1500-kw, three-phase, sixty-cycle alternator was built by the General Electric Company and is driven by waterwheels which are duplicates of the foregoing. All of the machines operate at 150 r.p.m. and are controlled by Lombard governors. Oil pressure for these governors is furnished by pumps belted to the generator shafts.

Duplicate Westinghouse exciters, rated at 100 kw, 125

volts, and 350 r.p.m., are installed in the center of the station. These units are driven by two 22-in. Dayton Globe waterwheels also controlled by Lombard oil-pressure governors. Mechanical governors are generally deemed sufficient for such exciter units, but in this case particularly good regulation was sought and the oil governors were chosen.

FIG. 7—TAILRACE, RAPIDS POWER PLANT

The switchboard, which may be seen in Fig. 12, consists of eight panels of blue Vermont marble with vacant frame space at the extreme end for an additional panel should it be needed. Enumerating from the farther end of the board, it will be noticed that upon the blank frame space a recording wattmeter and voltmeter have been placed temporarily. Panel No. 1 is a high-tension totalizing panel and carries, besides its oil switch, three 1000-amp ammeters. Since it is expected at some time that another high-tension line will leave the station and extend toward the north, panel No. 2 has been installed as a totalizing panel and at present is connected in series with panel No. 1. In addition, there is a three-phase ground detector and a polyphase



FIGS. 8 AND 9.—33,000-VOLT AND 2200-VOLT LINES FROM HYDROELECTRIC STATION

integrating wattmeter. Panels 3, 4 and 5 control the alternating-current units and have their equipment installed in duplicate. Each consists of three 600-amp ammeters, one polyphase wattmeter with a 1600-kw scale and one direct-current ammeter for measuring excitation current. In addition to these instruments, the board carries rheostat control, synchronizing push buttons controlling the motors on the Lombard governors, voltmeter plugs and one main oil switch. Contemplating the installation of a fourth generator unit, panel No. 6 has been left blank. Panel No. 7 carries the metering and control equipment for both exciter units, consisting of two 1200-amp ammeters and one 150-volt voltmeter, rheostat control, voltmeter plugs, two 250-volt, 800-amp, double-pole single-throw switches and one single-pole switch used as a bus tie. The frequency meter, power-factor indicator and duplicate Tirrill regulators for the station are located on panel No. 8. Two voltmeters, one for the generators and one for the outgoing line, are mounted on the swinging bracket with the synchroscope.

The board is spaced 8 ft. from the wall and is supported by an angle-iron framework, which gives ample room at the rear for mounting grid resistors for the various machines. As a means of stopping the large generators, which when running light will continue to revolve under their own momentum for several hours, a galvanized-iron tank has been placed behind the board

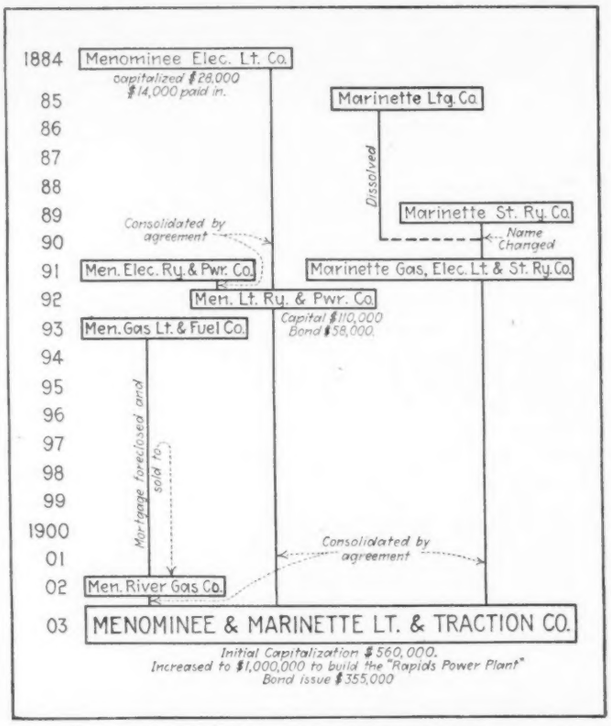


FIG. 10—GENEALOGICAL CHART OF MENOMINEE & MARINETTE LIGHT & TRACTION COMPANY

and connected as a water rheostat. By loading the three phases of a unit with this resistor a machine may be brought to rest in a very few minutes. A direct-current motor-driven air pump, which has completed its tenure of usefulness on the rolling stock of the local street railway, supplies compressed air for cleaning the generators and other electrical equipment.

Transformers and Other Features

In the transformer room from which the high-tension line is shown emerging in Fig. 8 are seven 750-kva, 2200/33,000-volt, Westinghouse single-phase, oil-insulated, water-cooled transformers. The buses connecting the two sets of transformer units with the machine switches and electrolytic lightning arresters are carried on racks of pine timber. As a precaution against fire originating in this compartment a fireproof door may be lowered to separate this room from the main generating station. Disconnect switches are inserted in the low-tension and high-tension leads so that any part

of the equipment may be isolated if repairs are needed.

In an easterly wing of the power house a machine shop and boiler room are provided. The machine shop equipment consists of a lathe, drill press, forge, grindstones and emery wheels all driven from a line shaft by a 5-hp, 220-volt General Electric motor operating at 4700 r.p.m. In the boiler room an old stationary steaming unit which was used in construction work about the station has been placed on a concrete foundation and now furnishes steam for heating the power house and the houses of the employees. A 1-hp, 220-volt Fort Wayne motor driving a Paul pump supplies the feed water for this boiler. The action of the pump is controlled automatically through an arrangement of contact-making pressure gages.

Transmission Lines

Practically all of the energy generated by this hydroelectric station is delivered over a 33,000-volt transmission line to the substation in Menominee, 20 miles distant. The three phases of the line are spaced at the corners of an equilateral triangle measuring 52 in. on a side. A single cross-arm and one cast-iron top bracket support the double-petticoat porcelain insulators furnished by the Ohio Brass Company.

The poles are spaced 117 ft. apart in a cleared right-of-way throughout the entire 20 miles. Forest fires, which rage throughout this country in the dry seasons

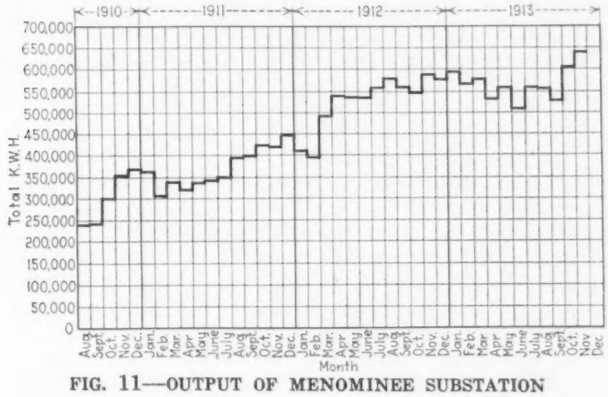


FIG. 11—OUTPUT OF MENOMINEE SUBSTATION

of the year, make it almost imperative that all wooden-pole lines shall be run upon cleared rights-of-way. Thus far, however, no service interruptions have been caused by the forest fires.

En route to Menominee, the high-tension circuit serves an outdoor substation supplying the community of Wallace, described in the *Electrical World* for Oct. 18, 1913. In passing, it is interesting to note that this tiny village now boasts of two double-faced electric billboard signs measuring 9 ft. by 20 ft. and lighted by twenty 25-watt tungsten lamps.

Menominee Substation

At the substation in Menominee seven 675-kva, 33,000/2200-volt, sixty-cycle Westinghouse transformers of the water-cooled, oil-insulated type step down the voltage for the distribution circuits. The lightning-arrester, high-tension and low-tension switching equipments in this station are duplicates of those at the transformer house of the power station. A portion of the 2200-volt energy is transmitted to the paper mills at Marinette, which are large consumers of electric energy, being stepped up to 6600 volts by a set of 150-kva General Electric transformers. Two motor-generator sets supplying 500-volt direct-current energy for the street-railway system are interesting from the fact that the two 150-kva, 500-volt Westinghouse direct-current generators were taken from the old steam-power plant and are now driven by two 220-hp, 2200-volt, 600-r.p.m., sixty-cycle General Electric synchronous motors.

The switchboard in this substation consists of ten panels of blue Vermont marble, most of which were formerly located in the old steam plant. With the discontinuance of the regular use of this station most of the metering and switching equipment for distribution

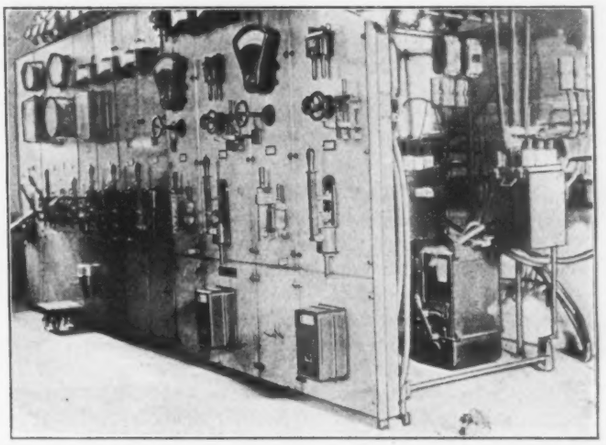


FIG. 12—SWITCHBOARD IN MENOMINEE SUBSTATION

circuits was transferred to the Menominee substation.

The arc-lighting circuits in the cities of Menominee and Marinette are supplied with energy by fifty-lamp tub-transformer sets, two of which are located in the Menominee substation. A transformer station in Marinette containing three tub transformers receives energy at 2200 volts and distributes it to the series lighting circuits in that city.

Organization and Output

Fig. 11 shows the output for the Menominee substation from the time the hydroelectric plant on the rapids of Menominee River was put in operation in August, 1910, to the end of November, 1913. In that time the output has risen from 240,000 kw-hr. to 640,000 kw-hr. per month. The increase is largely attributed to the growth of the lighting and industrial-motor business, since the street-railway property has not grown materially in that time. Fig. 13 shows a daily load curve for Dec. 5, 1913, which is considered to be typical for the plant.

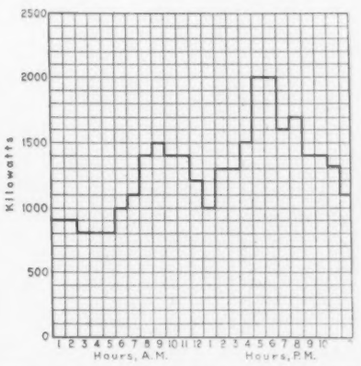


FIG. 13—TYPICAL DAY LOAD CURVE

Mr. Edward Daniell, who has been associated with the parent company since an early date, is secretary and manager of the Menominee & Marinette Light & Traction Company, and in his work he is assisted by Mr. Albert W. Raiche, purchasing agent, and Mr. L. H. Lathrop, superintendent. Mr. J. C. Sprong is chief operating engineer of the hydroelectric station.

Checking Watt-Hour Meter and Wattmeter Connections

Simple methods of verifying connections of single-phase and polyphase meters where power-factor is uncertain. By Raymond S. Brown and P. Ackerman

A Simple Method of Checking Watt-Hour Meter Connections

BY RAYMOND S. BROWN

When making an installation of watt-hour meters to measure the energy delivered to a polyphase load, or when inspecting the connections of such meters already in place, the meterman frequently feels the need of some means, other than a diagram, of checking the correctness of his connections. In many cases it is very difficult to trace out the leads runnning to the meters as they are sometimes inclosed in conduit or run in dangerous proximity to high-tension cables. In order to afford a reliable test which can be made without the annoyance of tracing out the wiring, and which may be applied by anyone not familiar with meters, the following method has been devised and used with good results.

It is assumed that the ordinary two-wattmeter method is used, employing either two single-phase meters or one polyphase meter. Inasmuch as a polyphase meter is electrically equivalent to two single-phase meters, the following discussion will be confined to the method using two meters.

It is a well-known fact that the only time when the two meters will rotate at the same speed is when the power-factor of the load which they are measuring is unity. The direction of rotation of the slow meter will be governed by the power-factor of the load, and, when properly connected, it will rotate forward for power-factors above 50 per cent—that is, for a lag angle of 60

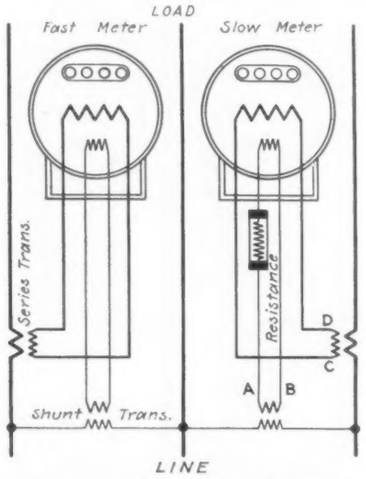


FIG. 1—LOCATION OF RESISTANCE FOR CHECKING CONNECTIONS OF SLOW METER

deg.—and backward for power-factors below 50 per cent. This is due to the fact that the current in the meter, under balanced conditions, lags behind the potential across the meter by 30 deg. *more* than the load current lags behind the load voltage. Hence, when the lag angle is 60 deg. for the load, it is 90 deg. for the meter. In the case of the fast meter the angle between current and voltage is just 30 deg. *less* than the corresponding angle of the load; hence, for ordinary commercial loads this meter will always run forward. This makes an incorrect connection on the fast meter very easy to detect, as this meter must always rotate in the direction which the manufacturer has designated as forward. In the case of the slow meter, however, the

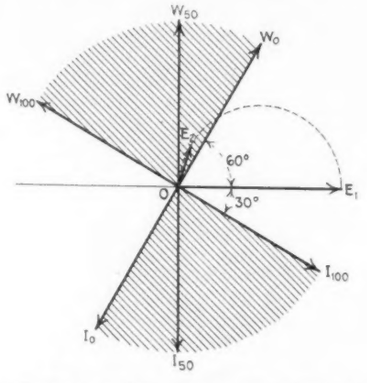


FIG. 2—PHASE RELATIONS IN SLOW METER

direction of rotation is not a criterion unless it is known whether the power-factor of the load is above or below 50 per cent. In a great many cases the power-factor of the load is not known. That it is frequently below 50 per cent is evident when we consider that the load may consist largely of the magnetizing current to distributing transformers or to induction motors lightly loaded.

Fig. 1 shows the connections for metering a load by the use of series and shunt instrument transformers. It is assumed that each meter is connected to the proper transformers but that the polarity of the leads coming from these transformers is unknown. A reversal of leads *AB* or *CD* may be caused by improper connections on either the primary or the secondary side of the transformers, and will result in this meter running in the wrong direction.

The test for the connection of the slow meter consists in inserting a resistor of high resistance in series with the potential circuit. If the meter is properly connected this will cause it to rotate backward; if it is improperly connected it will rotate forward. The resistance used need not be accurately calibrated. The only conditions necessary are that it be practically non-inductive and of a magnitude sufficient to cause the potential across the meter to drop to less than half its initial value. For 110-volt meters it should be of the order of about 10,000 ohms, hence the internal resistance of a voltmeter may be conveniently used. For general use in making this test, however, it is recommended that the resistor of high resistance be made by compressing in a short fiber tube a mixture of powdered graphite and chalk. Brass plugs should be cemented into the ends of the tube, one plug terminating in a straight rod for inserting into the potential bushing of the meter and the other terminating in a binding screw for attaching a lead. Such a

resistor may be carried about in the vest pocket.

The theory of the test is very simple, as may be seen by referring to the diagram of vector relations shown in Fig. 2. The lower shaded quadrant represents all possible locations of the meter current I with respect to the meter voltage E_1 when the meter is properly connected. The upper shaded quadrant represents all possible locations of the current vector W when the meter is wrongly connected, owing to one pair of leads being reversed. The current subscripts refer to load power-factors. E_2 represents the voltage obtained across the potential coil when the high resistance is inserted. The potential coil being almost pure reactance, the effect of inserting the resistance is to rotate the current in this coil forward approximately 90 deg. In like manner the reactance drop is rotated forward 90 deg., its locus being the arc of a circle. The meter will run forward when the angle between current and voltage is acute and backward when this angle is obtuse. Since the angle made by E_2 with any current in the lower quadrant is obtuse and with any current in the upper quadrant is acute, the rule quoted above follows. Of course the speed is much less with the resistance in the circuit, but all that is needed for the purpose of the test is sufficient torque to cause the disk to move.

For polyphase meters the same procedure is followed except that the fast half of the meter is disconnected.

Incidentally the use of this high resistance may be made to serve another useful purpose to the meter tester. It is the custom with most electric-service companies to calibrate their meters in place at more or less regular intervals. The test is usually conducted at 50 per cent and 100 per cent power-factor and loads ranging all the way from light to full. The 50 per cent power-factor for the test is obtained by the use of a phantom load containing a combination of reactances and resistances. It is possible to eliminate the use of reactance entirely and thus somewhat simplify the testing outfit, if power for the phantom load be taken, not from the same phase as the potential circuit, but from the phase supplying current to the potential circuit of the other meter, which has a 60 deg. relationship with that of the first meter. This will probably give 50 per cent power-factor; but it cannot be predicted whether the current will be lagging or leading 60 deg. owing to the fact that the direction of phase rotation is unknown. If, however, the high resistance be momentarily inserted, the question will be answered. If the current is lagging, as it should be, the meter will run backward. If the meter runs forward the current is leading, and the desired result will be obtained by interchanging the phases used for potential and load respectively.

Method of Checking Polyphase Wattmeter Connections Where Power-Factor Is Uncertain

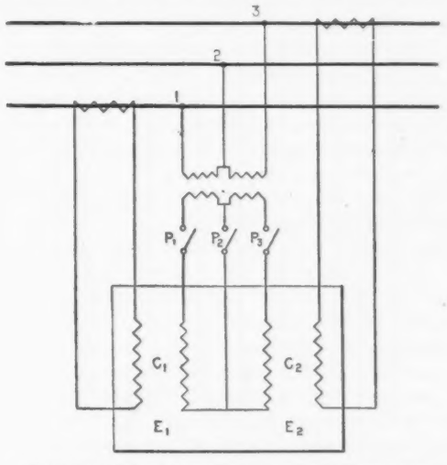
BY P. ACKERMAN

The checking of polyphase wattmeter connections often causes considerable trouble, particularly in cases where the checking has to be made without interfering with the operation of a plant, or where the power-factor is not known, or where intermittent service causes a continuous fluctuation of the power-factor near 50 per cent. For such cases the simple method developed below is very advantageous. It allows one to check with a single reading the correct connections of the meter without knowledge of the power-factor, provided the proper current and potential circuits are connected to their respective single-phase meter elements.

The usual feed connections of a polyphase wattmeter are as shown in the sketch. The meter consists of two single-phase elements, each comprising a current coil and a potential coil. The two potential instrument transformers are normally tied together on open delta, such as is usually the case with the two potential coils in the meter, so that only three instrument leads extend from the transformers to three potential binding posts on the meter.

If now potential lead P_3 is opened, the only meter element E_1 acts, since on meter element E_2 the potential is interrupted, or if P_1 is opened, then only meter element E_2 will act. The two individual single-phase meter elements are known to act with proper connections in the same direction with a power-factor above 50 per cent and in opposite directions with a power-factor below 50 per cent, and it is, therefore, common practice, wherever the power-factor is known, to check the proper connections by checking the proper direction of action of the two single-phase meter elements. However, the power-factor not always being known, the principle cannot be applied in all cases. For such cases the following method is applicable.

If the common potential lead P_2 is disconnected, then the potentials of both meter elements will be in phase with the potential P_1-P_3 since both potential coils are in



POLYPHASE WATTMETER CONNECTIONS

series connection between the two potential leads P_1 and P_3, and the voltage absorbed by the potential coil of each meter element will be half of the voltage, P_1P_3. Estimating the size and direction of the three individual readings—that is, with open potential lead P_1, then P_3, and finally P_2, with proper connections—the values shown are obtained for different power-factors.

TABLE I—READINGS WITH CORRECT METER CONNECTIONS

Power-Factor, per Cent	E_1 with P_3 Open	E_2 with P_1 Open	E_1+E_2 with P_3 Open
100	+50	+50	+50
86	+33	+67	+50
50	0	+100	+50
26	−62	+162	+50

the reading being given in percentage of the total meter reading.

From Table I it is seen that with proper connections the reading with open common potential lead P_2 will always be half of the total wattmeter reading and positive in its direction, while as shown by Table II the direction would become negative if the low single-phase reading should be reversed.

Therefore the following simple rule can be deduced for checking wattmeter connections of uncertain power-factor:

First—Check first carefully the connections of shunt and series transformers and make sure that the proper current and potential circuits are combined in the same single-phase meter element.

TABLE II—READINGS WITH CURRENT OF LOW-READING ELEMENT REVERSED

Power-Factor, per Cent	E_1 with P_3 Open	E_2 with P_1 Open	E_1+E_2 with P_2 Open
98	−285	+385	−50
86	−92	+192	−50
50	0	+100	−50
26	+28	+72	−50

Second—So connect the current leads to their respective meter coil as to obtain a positive total reading.

Third—Open the potential circuit P_3 and note the direction of the reading; if positive, then the meter connections are correct; if negative, the current leads of the low-reading meter element have to be reversed. After obtaining a positive reading with P_3 open, the direction of the low-reading meter element will tell whether the power-factor of the load is above or below 50 per cent, negative reading indicating a power-factor below 50 per cent and positive reading a power-factor above 50 per cent.

Therefore the method can be used just as well as a rough check on the power-factor.

The meter-man will appreciate such a simple rule since it will help him to solve many difficult problems where the power-factor of a system is not known or in cases where methods based on the two single-phase meter element readings cannot be safely applied, as, for instance, in very intermittent service or where the power-factor varies around 50 per cent.

It must be borne in mind that the check is correct only after the potential and current leads belonging to the same meter element have been located.

The method was developed by the writer when he found it necessary to check wattmeters of a large pulp and paper mill without interfering with the operation. The checking was complicated by the fact that many of the circuits showed a power-factor close to 50 per cent, one single-phase meter element indicating almost zero, while other circuits had very intermittent load and others, again, showed very low load so that any other methods known to the writer could not be applied under the particular circumstances.

The writer does not know whether the method is partly known or not, but, not having been able to find it in any literature, he thinks the publication of the method might be of general interest.

Farming a Transmission-Line Right-of-Way

The new transmission circuit of the Pennsylvania Water & Power Company from Holtwood into Baltimore occupies a purchased right-of-way strip 100 ft. in length. This 500-acre "shoestring" plot is not, however, allowed to remain unproductive, for with the real spirit of conservation the company has permitted nearby farmers to rent its land at a nominal figure, so that every inch of soil is being worked, even the ground beneath the towers being planted.

Loop Transmission System for Eastern Michigan

Changes and extensions to be made next spring will convert the existing transmission lines of the Eastern Michigan Edison Company into a loop system. Most of the energy distributed by this company is generated in hydroelectric plants situated on the Huron River be-

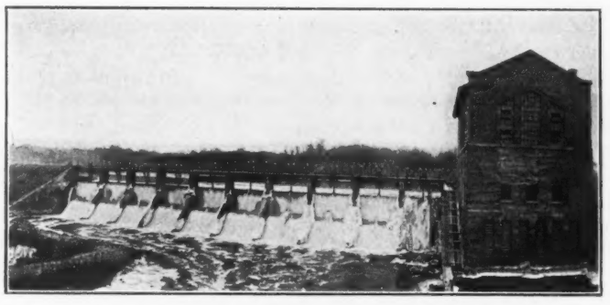


FIG. 1—NEW PLANT AT ANN ARBOR, MICH.

tween Ann Arbor and Ypsilanti, Mich., while some is purchased from the Detroit Edison Company.

At present there radiate from Detroit three 23,000-volt transmission circuits. One extends northwesterly to South Lyons, while the other two run west, separated by a distance of several miles but finally joining near Ypsilanti. Continuing in the same general direction, the resulting line connects with the Superior, Gettes, Argo and Barton generating plants on the Huron River. Since the completion of the latter plant at Ann Arbor last spring, stub-end lines have been extended to the north and west, feeding the towns of Whitmore Lake and Dexter respectively.

The plan now adopted contemplates extending the line from Whitmore Lake to South Lyons, which is only a few miles distant, in this way connecting all of the hydroelectric plants on the Huron River with Detroit by the northern circuit. The two southern lines previously mentioned will be disconnected at their present junction point near Ypsilanti and continued to the Superior plant as two distinct points. The Superior

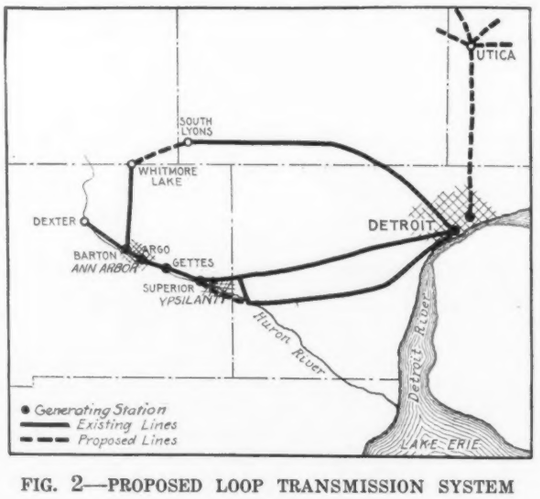


FIG. 2—PROPOSED LOOP TRANSMISSION SYSTEM

plant is now connected with the main generating station at Gettes by a single line, but a duplicate circuit will be provided eventually. When these changes are made three circuits traversing as many different territories, and subject to different disturbances, will be provided between the group of hydroelectric stations and Detroit.

Reinforced-Concrete Poles as Cheap as Wood

How 25,000 poles were manufactured and installed by the Toronto Hydro-Electric System—Advantages of concrete poles—Tests and costs. By J. G. Jackson

ALTHOUGH reinforced-concrete poles have been the subject of experiment from time to time for a great many years, it is comparatively recently, so far as the writer is aware, that they have been employed or even seriously considered. The high and increasing cost of wooden poles, their comparatively short life, with consequent prospective renewal at greater expense, as well as the public demand for the beautification of city streets, render the consideration of concrete-pole construction desirable for modern overhead systems.

Quite a number of successful installations of concrete poles have been made during the past five or six years on this continent and in Europe. Perhaps the largest single installation at present is that of 25,000 poles designed by the writer and installed in connection with the municipal street-lighting and general light and power distribution system of the Toronto Hydro-Electric System in Toronto, Canada, during 1910, 1911 and 1912.

The adoption of concrete poles for this installation was due to the necessity of supplying energy to the entire city, comprising over 400 miles of streets, from overhead lines, underground construction being in general too expensive except for the business districts, and a realization that more wooden poles and overhead construction of the usual type, added to streets already occupied by at least two such systems, would be decidedly objectionable.

It was felt that the appearance of an overhead installation could be greatly improved by employing a pole of neat and uniform construction such as could be obtained by the use of concrete. With a suitable lighting system and arrangement of overhead wiring, a pleasing, and, in fact, ornamental, effect can be secured at a cost substantially the same as when wooden poles are employed and with a prospective saving in maintenance expense. This would appear to be of especial interest to the smaller cities and residence districts of large cities, where the demand for underground construction is based mainly on esthetic considerations but where such construction is not justified by the revenue to be obtained.

In this connection it might be noted that in the recent installation of a street-lighting system with which the writer was concerned, for a city of approximately 10,000 inhabitants, the usual practice of installing a "white way" with underground wiring in the business section and gooseneck fixtures on wooden poles in the residential district was abandoned in favor of the installation of concrete poles throughout. This arrangement resulted in a smaller cost for the entire installation, a decorative system in the residence districts and a "white way" with tungsten clusters carried by heavy cast-iron brackets of ornamental design mounted on the faces of the concrete poles. This, in the writer's opinion, was not lessened in effectiveness by the small number of wires overhead. The concrete poles also served to carry the trolley span wires where necessary, so that, as in the case of steel trolley poles similarly employed, a minimum of street obstruction resulted.

Design and Construction of Poles

In the design and construction of the poles employed in the installations referred to an effort was made to eliminate unnecessary details and to render the manufacture as simple as possible in order that poles might be turned out rapidly and at low cost. A pole of solid square cross-section with beveled edges was adopted. The square section not only made possible a simple form of mold, but, as the strains to which a pole is subjected are ordinarily either normal to or in the direction of the line, this is obviously the most efficient arrangement of the material, especially with the longitudinal reinforcement grouped at the four corners, as 50 per cent of these members are then equally effective in tension in any direction normal to a face of the pole. As the majority of the Toronto poles were intended to

FIG. 1—A TWO-WEEKS' RUN IN POLE YARD, 112 POLES PER DAY BEING TURNED OUT

carry an ornamental lighting bracket and tungsten lamp, they were provided with a ½-in. iron pipe cast in the pole with lower outlet at the lamp and upper outlet under the line wires.

The earlier poles of the Toronto installation were provided with three galvanized-steel cross-arms cast in the pole and having a hole at each end for a steel

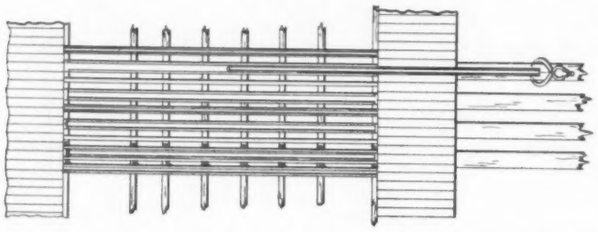


FIG. 2—METHOD OF HANDLING AND SUPPORTING POLES

core pin. This arrangement of cross-arms was not found sufficiently flexible in obtaining clearances of the lines and was later discarded. Holes were provided through the pole with a slot on either face so that brackets of any desired length could be bolted to the pole.

The concrete poles employed in this installation ranged from 24 ft. to 35 ft. in length, the majority being 24 ft. long. Standard poles were made with 8-in. by 8-in. base and 5-in. by 5-in. top for 24-ft. poles, with 9-in. by 9-in. base and 6-in. by 6-in. top for 30-ft. poles, and with 10-in. by 10-in. base and 6-in. by 6½-in. top for 35-ft. poles. The longitudinal reinforcement consisted of four deformed or square twisted steel bars of high elastic limit set at the corners of the pole and ½ in. from the surface. Three-eighth-inch bars were used in the 24-ft. poles and ½-in. bars in the longer poles.

Extra reinforcement consisting of additional bars extending part way up the pole was provided where poles were expected to be subjected to considerable strain. The cross-sections of the poles were determined with regard to the resulting appearance as well as from considerations of strength and cost. As all of these poles were intended for use on city streets, wind stresses could be considered to be a minimum owing to the sheltered location. With the exception of poles on curved streets, the lateral stresses result mainly

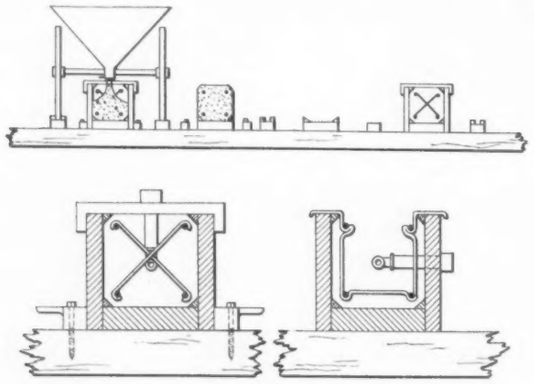


FIG. 3—METHOD OF POURING CONCRETE AND REINFORCING

from service lines to buildings. It is probable that the greatest strain that the majority of these poles would be sujected to was that due to handling in transportation and erection. The reinforcement provided, giving an ultimate strength as measured by the horizontal pull applied at a point 2 ft. from the top ranging from approximately 500 lb. in the 24-ft. poles to 800 lb. in the larger sizes, with extra reinforcement as stated, has been found to be sufficient for the conditions obtaining in Toronto.

Poles at ends of lines or at corners were ordinarily well guyed. Insufficient guying at occasional points, however, resulted in considerable deflections of the poles concerned, with consequent easing up of strains; but in comparatively few cases did breakage of poles result.

A number of poles 24 ft. long with 7-in. by 7-in. base and 4-in. by 4-in. top provided with four ¼-in. plain square reinforcing bars were experimented with when determining the sizes of the poles to be employed. These poles were found, at thirty days or thereabouts, to be incapable of withstanding the handling and transportation. It is of interest to note that in tests made on poles thirty days old with plain square-bar reinforcement failure resulted from slipping of the reinforce-

FIG. 4—CONCRETE POLE LINE IN RESIDENTIAL SECTION OF TORONTO, CAN.

ment in the case of ⅜-in. and ½-in. bars. One-quarter-inch square bars broke without appreciable slipping.

Manufacture of Poles

The plant employed in the manufacture of these poles consisted in the main of parallel horizontal forms arranged in rows with a runway at one end of the forms for the delivery of concrete, together with concrete mixer and special wagons for placing the concrete in the poles. All forms were constructed of finished Southern pine as more satisfactory results were obtained with this wood than with the less dense and resinous Northern variety. Bases of forms were spaced 2 ft. apart with wooden rails between, one pair of sides being provided for each three bases. A very wet mixture of concrete in the proportions of one part cement to two parts of sharp sand and four parts of crushed limestone of less than ½-in. size was used. The quality of sand used was found to have an appreciable effect on the characteristics of the pole, a sharp sand, as would be expected, tending to produce

the more elastic concrete. Gravel instead of crushed stone was found to give satisfactory results.

A number of mixtures less rich in cement were tried but were found to give a pole somewhat inferior in strength at ages up to thirty days covered by the period of test. The surface, also, was not so good as with the richer mixture. The 1:2:4 mixture employed gave an

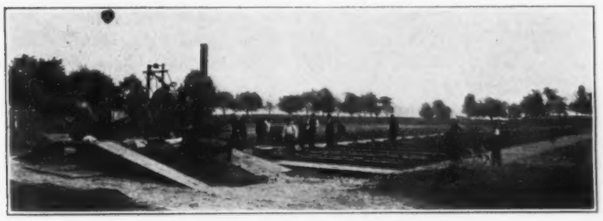


FIG. 5—POLE YARD, SHOWING MIXER AND POURING WAGON

excess of cement and sand beyond that required to fill the voids in the stone. The method of placing the liquid concrete by pouring from a spout in the bottom of the concrete wagon resulted in the almost complete elimination of air bubbles without special spading or working of the concrete for this purpose after placing in the forms. A small amount of troweling was necessary for the finishing of the upper surface, however. The poles made in this way, when set, presented smooth white cement surfaces showing the grain of the wood on three faces. The hand-finished upper surface was dressed by means of carborundum bricks after removal from the form.

Method of Casting

In casting the poles sides were set up and forms poured on every third base during the first day. On the following day the side walls were removed from the first poles and advanced to the second base, and the operation was repeated. On the fourth day the first poles cast were removed from the forms and the cycle of operations was started again. The removal of poles from the forms was accomplished by sliding the pole endwise from the form in stages a distance slightly greater than its length every third day, until sufficiently set for handling.

In the first stage, in order to prevent overstraining of the green poles, an extension of the base consisting

FIG. 6—FAILURE BY SLIPPING OF BARS

of a 2-in. plank slightly wider than and equal in length to the pole was provided. The withdrawal was accomplished by gripping the base of the pole by means of a particularly robust pair of ice tongs made for the purpose, the tractive effort being supplied by a horse attached to a rope on the tongs. Poles were commonly loaded on the outgoing wagons, or piled for storage after the third stage, at approximately ten days after casting.

Process of Reinforcement

Vertical reinforcement was placed by laying it in the form on wire hangers suitably spaced and with open hooked portions to carry the reinforcing bars. The

FIG. 7—INITIAL CAST WITH POLES ON EVERY THIRD BASE

lateral reinforcement intended to take up the vertical shear and to prevent failure by buckling consisted of a series of short bars with hooked ends dropped diagonally across the longitudinal members at intervals and for a distance above and below the ground line proportioned to the strain to be provided for. No effort was made to bind the longitudinal reinforcement in a cage by means of the suspension wires or together by means of the cross-reinforcing bars except by hooking together as noted and depending on the setting of the concrete to complete the bond and lock the reinforcement in place.

This method of reinforcement resulted in a minimum cost both for labor and for material. Repeated inspection of poles cast in this way and afterward broken on test or otherwise proved the method of setting the reinforcement to be sufficiently accurate and the lateral reinforcement to be capable of developing the full strength of the longitudinal steel. It is ordinarily desirable, however, that the lateral reinforcement be such that the pole will fail by crushing of the concrete rather than by breaking of the bars in tension, as in the former case a very considerable force will yet be required to bring the pole to the ground, which would seem to be an advantage in view of the weight of the pole, although the wiring carried would ordinarily prevent the falling of an overstrained pole.

FIG. 8—FAILURE BY BREAKING BARS IN TENSION

In the manufacture of the Toronto poles three yards were employed during a part of the time, turning out approximately 250 poles per day. Two of these yards were adjacent and employed the same men and equipment, giving an output of 150 poles per day practically at one point. The third ward was located several miles distant in order to shorten the haul for the finished

poles to the points of erection. One of the yards with forms for more than 100 poles per day was operated for three successive years and was still in fairly serviceable condition at the end of that time, notwithstanding the exposure of a part of the forms to the weather during two winters.

While the majority of these poles were cast out of

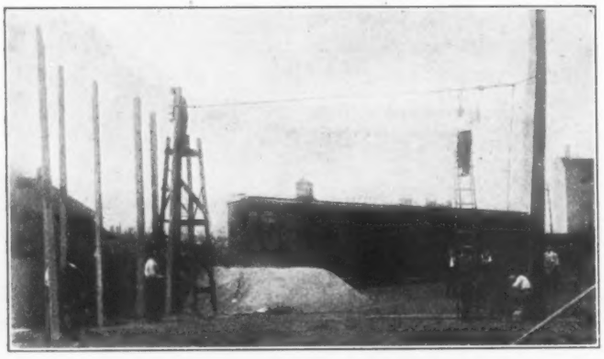


FIG. 9—TESTING CONCRETE POLES

doors, about 2000 were made in a large building during the winter of 1910-11. The labor cost under these conditions was approximately double that found necessary with unrestricted space.

Erection of Poles

Delivery of poles to erection gangs was carried out by means of ordinary wagons upon which oak frames were set to provide several points of support for the poles—a load consisting of six 24-ft. poles weighing 1100 lb. and four 30-ft. poles weighing approximately 1600 lb. Poles were lifted onto the wagons by a loading gang without special equipment and were lowered to the ground on skids.

Ordinary labor was employed in the erection under the direction of line foremen. While three poles erected per day per man was accomplished under favorable circumstances, the average was slightly less than this. Raising pikes with a forked end were used, and poles were lifted and dropped into the holes in the same manner and with the same care as in the case of wooden poles. Twenty-four-foot poles were set 4 ft. in the ground and 30-ft. poles 5 ft. The holes were refilled with the excavated earth, no concrete bases being employed. The small sizes of the bases as compared with wooden poles resulted in a smaller cost for digging holes as a minimum diameter was excavated. While the cartage of concrete poles was comparatively expensive as a result of the weight, the cost of handling and erection was approximately the same as for wooden poles, with a possible advantage in this instance for the concrete pole as a result of the larger number erected and the fact that ordinary labor was employed for this purpose.

Results in Practice

Notwithstanding the fact that no special precautions other than ordinary care were taken in handling the poles, the total breakage on approximately 25,000 over a period of about three years covering manufacture, erection and operation was less than 2 per cent. Failure while in service during this period was a small fraction of 1 per cent per year and resulted mainly from collisions with heavy vehicles and obvious overstraining. While several thousand of these poles have been in service during three winters, carrying from three to six lines ranging from No. 6 to No. 2 and larger, in addition to frequent services to buildings, they appear, except in a number of cases where overstraining is apparent, to be in as good condition as when erected, and inspection of the concrete indicates the improvement which would be expected with age. With the exception of a number of poles which were frozen before the setting of the concrete, no deterioration of the concrete appears to have developed, and examination of the reinforcement of poles broken gives evidence of the preservation of the steel.

COST OF STREET-LIGHTING POLES DESIGNED TO CARRY SIX WIRES AND ORNAMENTAL TUNGSTEN-LAMP BRACKET WITH CONDUIT CONNECTION

24-ft. Pole, 8-in. by 8-in. Base, 5-in. by 5-in. Top; Volume of Concrete, 7 cu. ft.	
Cement, at 40 cents per bag	$0.700
Stone, at $1.33 per ton	0.400
Sand, at $1.15 per yd.	0.145
⅝-in. steel reinforcing bars, at $1.95	0.889
Suspensions for reinforcing bars	0.056
Lateral reinforcing bars	0.100
½-in. pipe and fittings	0.268
Three galvanized-steel cross-arms	0.262
Miscellaneous material	0.050
Depreciation of forms	0.400
Mixer and other plant	0.120
Preparing yard	0.080
Total	$3.47
Labor	1.05
Total labor and material etc.	$4.52
Adding for engineering supervision, office expenses, 10 per cent	0.45
Total	$4.97*

30-ft. Pole, 9-in. by 9-in. Base, 5-in. by 5-in. Top; Volume of Concrete, 12 cu. ft.	
Cement	$1.200
Stone	0.710
Sand	0.255
½-in. steel bars, at $1.85	1.893
Suspensions	0.072
Lateral reinforcing bars	0.140
½-in. pipe and fittings	0.430
Galvanized cross-arms	0.262
Miscellaneous	0.060
Forms	0.500
Mixer and other plant	0.120
Yard	0.080
Total	$5.72
Labor	1.31
Total labor and material	$7.03
Plus 10 per cent	0.70
Total cost	$7.70

*This, of course, includes the iron conduit pipe and galvanized steel cross-arms, so that the cost of a plain 24-ft. pole would be $4.39 and that of a plain 30-ft. pole would be $6.97.

Cost of Poles

The costs of the concrete poles under the several conditions described were variable, but for a considerable part of the work approximated the figures given in the accompanying table.

It is apparent, of course, that in a comparison of costs of wooden and concrete poles the labor required in preparing the wooden poles and also the painting should be considered as a part of the cost, as the concrete pole is produced as a finished article. While con-

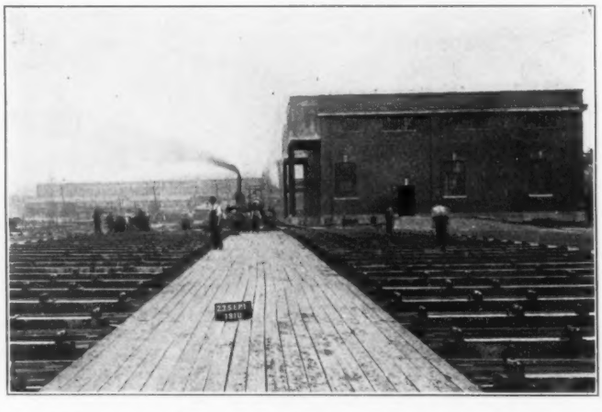


FIG. 10—CONCRETE-POLE YARD FROM CENTER RAILWAY

crete poles can compete, even in first cost, with wooden poles in many cases, and present decided advantages where appearance is a factor, as in the case of street-lighting systems, it is not, in the writer's opinion, probable that satisfactory or economical results will be had from the occasional manufacture of poles by inexperienced persons.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Christmas-Tree Outfits Loaned Without Charge

Wherever its electricity was available on the premises, the Minneapolis General Electric Company offered to lend Christmas-tree electric-lighting equipment to churches or charitable organizations without charge. This generous offer was accepted by about ninety applicants during the holiday season. Not all of the requests were for the same night, so that many of the outfits did double or triple duty. The electric-service company delivered the festoons of lamps and called for them after they had been used. Many letters expressing grateful thanks were received by the company.

Furthering Electric-Vehicle Development at Chicago

Addressing the Chicago Section of the Electric Vehicle Association on Jan. 6, Mr. John F. Gilchrist, vice-president of the parent association and also assistant to the president of the Commonwealth Edison Company, expressed a lively sense of the importance of the electric vehicle to central-station interests. After mentioning the fact that one manufacturer of electric commercial vehicles has announced a reduction in price, with the declaration that there will be in future no "trades" for second-hand machines, Mr. Gilchrist said that the association has amply demonstrated its usefulness already. One very important feature of its work is bringing together those who manufacture and deal in electric vehicles and those who produce and sell the energy by which the vehicles are operated. The speaker voiced in an unequivocal manner his conviction that the central-station men should co-operate with the vehicle men. It is no doubt true that the manufacturers and dealers in the electric-vehicle field are doing more than their share in the co-operative undertaking. The important men in the electric-service industry should be made to understand what the possibilities of electric-vehicle development mean to them. This may be a rather slow process of education, but it should be persisted in patiently and tactfully.

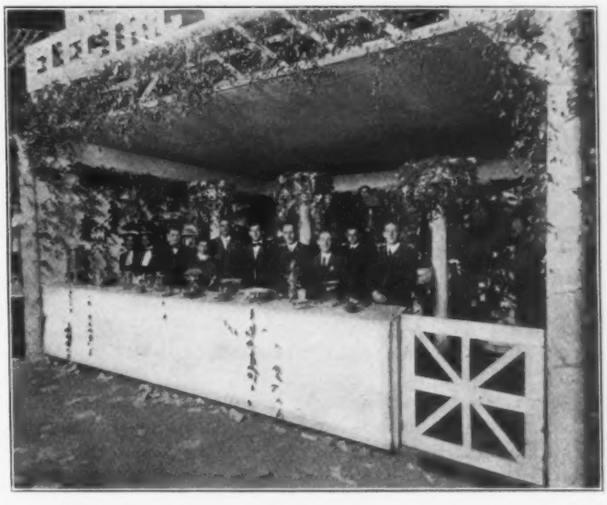
Mr. Gilchrist said that the Commonwealth Edison Company appreciates the electric vehicle and is trying to do some things to help it along. He spoke of the recent reduction in rates by which a tertiary rate of 4 cents (to be reduced to 3 cents on March 1) has been created for small lighting consumers. This new tertiary rate gives the private owner of, say, one electric passenger automobile a chance to put the charging of his batteries on the same maximum meter with the lighting circuits of his house. By using a little care so as not to charge during the time of peak demand, the individual owner of an electric car in Chicago should thus be able to get nearly all his energy for 3 cents per kw-hr. after March 1.

Another interesting statement made by Mr. Gilchrist was that the Commonwealth Edison Company is making a serious study of the Hartford plan of supplying charged batteries to owners of electric vehicles. By this plan the owner has nothing to do with the ownership, maintenance or charging of the batteries he rents for use on his car. When the driver finds that the battery needs recharging he proceeds to the nearest supply station and the entire battery is taken out, a freshly charged one being substituted in its place, the interruption to service of the electric vehicle being but slight. This plan may mean the possible standardization of batteries and battery housings on cars, but it would eradicate the annoyances of owners of small vehicle installations in maintaining batteries. The scheme may not be feasible in a large city like Chicago, but the company is giving the subject careful attention. The speaker concluded by reminding his hearers that Chicago is an ideal city for the electric vehicle, with its absence of grades and the great improvement in the quality of street paving which has been made in the last few years.

Mr. George Harvey Jones, of the Commonwealth Edison Company, mentioned the fact that the maximum rate for electrical energy to public garages as charged by the Commonwealth Edison Company, has been reduced from 5 cents to 4 cents.

Indirect Lighting in a Hurriedly Constructed Booth

At a show in which the Kansas City (Mo.) Electric Light Company participated only a short time was available for building, decorating and lighting the company's booth. In place of a ceiling white canvas was stretched over the top of the exhibit, giving a surface



BOOTH WITH INDIRECT LIGHTING

upon which the indirect lighting units in the display might project their rays. Since the ceiling was of canvas, the three heavy lighting units were supported on posts in the floor. These units are not visible in the illustration on account of the floral decorations wreathed about their exteriors. The Kansas City company is a firm believer in the advertising value of such displays.

Contract Agents Display Lighting Chart

When Mr. G. E. Bernecker, contract agent for the Commonwealth Power Company, Milwaukee, Wis., was taking up the matter of flat-rate display lighting with local merchants charts similar to that reproduced in the accompanying illustration were found of valuable assistance. The sketch herewith shows a block in the business

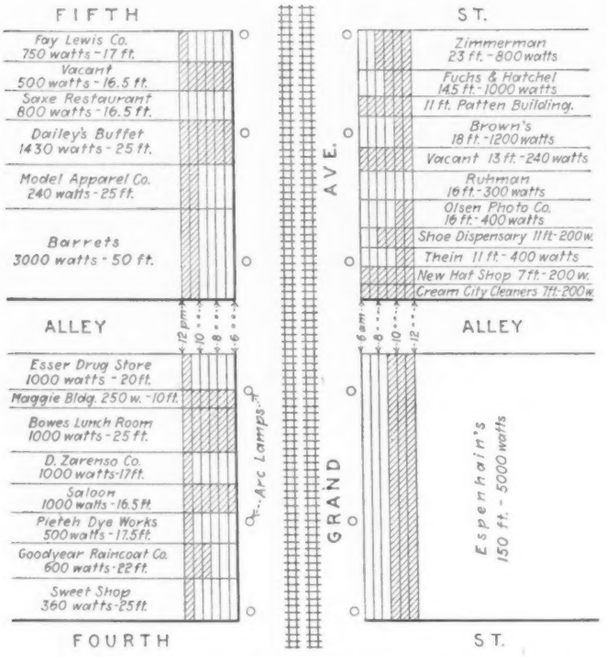

FIFTH
ST.
Fay Lewis Co. 750 watts - 17 ft.
Vacant 500 watts - 16.5 ft.
Saxe Restaurant 800 watts - 16.5 ft.
Dailey's Buffet 1430 watts - 25 ft.
Model Apparel Co. 240 watts - 25 ft.
Barrets 3000 watts - 50 ft.
ALLEY
Esser Drug Store 1000 watts - 20 ft.
Maggie Bldg. 250 w. - 10 ft.
Bowes Lunch Room 1000 watts - 25 ft.
D. Zarenso Co. 1000 watts - 17 ft.
Saloon 1000 watts - 16.5 ft.
Pieteh Dye Works 500 watts - 17.5 ft.
Goodyear Raincoat Co. 600 watts - 22 ft.
Sweet Shop 360 watts - 25 ft.
FOURTH
12 pm
10
8
6
Arc Lamps
GRAND AVE.
6 pm
8
10
12
Zimmerman 23 ft. - 800 watts
Fuchs & Hatchel 145 ft. - 1000 watts
11 ft. Patten Building.
Brown's 18 ft. - 1200 watts
Vacant 13 ft. - 240 watts
Ruhman 16 ft. - 300 watts
Olsen Photo Co. 16 ft. - 400 watts
Shoe Dispensary 11 ft. - 200 w.
Thein 11 ft. - 400 watts
New Hat Shop 7 ft. - 200 w.
Cream City Cleaners 7 ft. - 200 w.
ALLEY
Espenhain's 150 ft. - 5000 watts
ST.

CHART SHOWING POWER USED FOR DISPLAY LIGHTING

district of the city where window and other display lighting was turned on and extinguished by the customers themselves and indicates the irregularity with which the lamps were operated. Horizontal lines mark off the hours from 6 p. m. till midnight, and the unshaded portions indicate the periods of window-lamp operation. The offer made by the company contemplated a special display-lighting circuit controlled from the generating station or substations. The lamps were to be lighted at dusk and extinguished at midnight.

When the merchant was confronted with such a diagram showing the frontage of his own property and its connected lighting load, contrasted with that of his neighbors and competitors, very little argument was needed in favor of the well-lighted show window as a silent yet effective salesman to gain his support for the plan.

Advantages of Electric Drive in Woodworking Plant

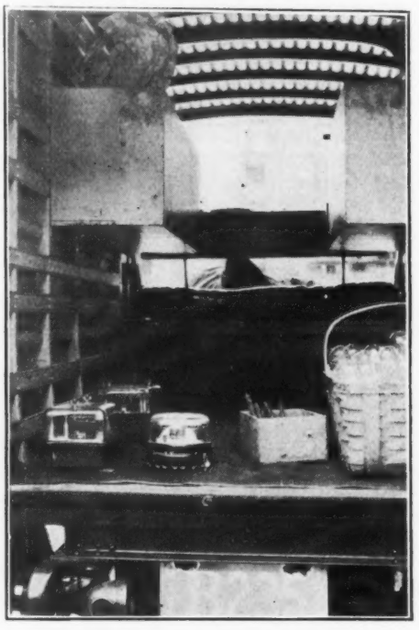
The Union Electric Light & Power Company, of St. Louis, is doing a good work by publishing in the daily newspapers advertisements giving the reasons of industrial customers for using central-station service. The case of the H. Pauk & Sons Manufacturing Company, 1309-1327 North Fifteenth Street, St. Louis, is cited as a recent example. This company manufactures store fixtures, barber chairs, showcases, etc. It replaced its steam plant with the electric service of the Union company in August, 1910, and since that time has relied upon the central-station service exclusively, having over 170 hp in motors in its establishment. In speaking of purchased electrical energy Mr. Pauk says: "As a result of installing motors on our woodworking machines we have increased our plant output. For the same cost of operation we very much prefer purchased energy to that of our own generation. It has cost us less to operate with central-station service than with a steam plant which we used for years."

New Year's Pledge in Minneapolis

The present management of the Minneapolis General Electric Company appears to be winning the hearty approval of press and public. In times gone by there have been some misunderstandings and disputes between the company and its patrons, but under the "new deal" everything appears to be adjusted satisfactorily. Mr. R. F. Pack, the general manager of the company, takes newspaper space to say that the advent of the year 1914 means to the company renewed efforts to please. In extending New Year's greetings the company gives its thanks to the many citizens who have given the company encouragement in its efforts to do its work better. The company concludes its New Year's announcement with this promise: "Every individual with this company will start the year 1914 inspired by renewed determination to render satisfactory service in the most pleasant and most efficient way."

Easy Riding for the Meters

To reduce the jars of transportation as much as feasible, the United Electric Light Company, of Springfield, Mass., equips its meter automobiles, which indidentally are of the electric type, with a thick velours pad placed on the floor as shown in the accompanying illustration. The cost is nominal and the improvement



VELOURS PADS FOR TRANSPORTING METERS

in riding conditions is marked. The company's officials felt that, in justice to the consumer and the central station alike, nothing should be allowed to interfere with the accuracy of its meters between the test board in its office building and the consumer's installation. Old and new lamps are carried conveniently in these cars in boxes attached to their inside walls.

Edison Service for New England's Largest Furniture House

The new ten-story building of the Paine Furniture Company, Boston, Mass., will be equipped with an elaborate installation of lighting and motor apparatus supplied with energy by the Boston Edison Company. The signing of the electric-service contract was exten-

ELECTRIC SIGN DURING BUILDING CONSTRUCTION

sively advertised in the Boston press, and during the construction period an electric sign, shown in the accompanying photograph, has called the attention of hundreds of thousands of people to the prospective use of electricity in the establishment. The sign is about 20 ft. long, the letters being 18 in. and 24 in. high, and it contains 297 10-watt lamps.

The new store will be equipped with 297 hp in motors and a connected lighting installation of 508 kw. Five 30-hp elevators and one 10-hp elevator will be in service. A 7.5-hp motor-driven dust fan, a 5-hp picker fan, two 5-hp sewage ejectors, a 2-hp air compressor and other fans will also be in use. A noteworthy feature of the establishment will be a large furniture manufacturing and repair shop equipped with 85.5 hp in motors ranging from 0.5 hp to 10 hp in rating. The shop tools will include a 7.5-hp ticking machine, 10-hp planer, 5-hp jointer, 1-hp rip saw, 10-hp circular saw, 5-hp cutting saw and other tools aggregating 36 hp.

Saving with Battery-Driven Fire Truck

According to figures prepared by the New York Fire Department, the battery-driven fire engine in its service has shown a saving of 40 per cent during the last year over the equivalent operating cost of a horse-drawn truck.

The total expense of operating the electric truck, which is of the couple-gear type equipped with U. S. L. thin-plate batteries, is estimated at $388.74 for the year, the following items being included:

Depreciation	$200.00
Energy, at 6 cents per kw-hr	117.90
Distilled water, sulphuric acid, brushes for motor, and other minor repairs	70.84
Total	$388.74

A comparison of this outlay with the cost of operating a horse-drawn engine shows a saving of $266.52 in favor of the battery-driven truck:

Horse-drawn truck	$655.26
Battery-driven truck	388.74
Saving	$266.52

During the year covered by the above figures the battery-driven truck responded to 319 alarms. One run of 6 miles was made through crowded city streets in twenty-three minutes, the truck at times exceeding a speed of 20 miles an hour.

"Your Partner," the Louisville Slogan

The Louisville (Ky.) Gas & Electric Company has adopted a new trade-mark. "Your partner" is the slogan which it bears, while a flaming sun and a flambeau at the sides suggest the service which the company renders. In an announcement to the public regarding the trade-mark, the company said:

"The new trade-mark of the Louisville Gas & Electric Company will stand for a service rendered in the spirit not of exploitation but of partnership. Not only shall this trade-mark stand for service of the highest grade at prices far lower than those prevailing throughout the country, but it also represents service pleasantly and courteously rendered. It shall represent a service for all the people, recognizing no lines of party, race, class or religion—the same grade of service for the humble cottage as for the mansion, charged for, without discrimination, according to the same low-rate schedule.

"Time and experience are necessary to put vitality into this trade-mark. Our best efforts and your friendly co-operation will be needed.

"The people and the company are partners."

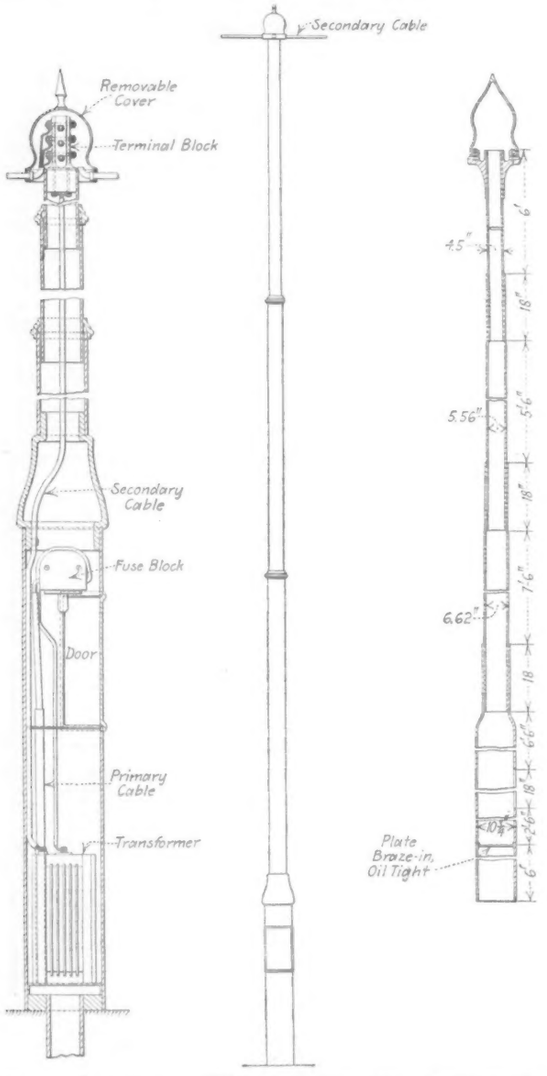
LOUISVILLE
GAS
AND
ELECTRIC
COMPANY
YOUR PARTNER
GOOD WILL
At this time when the subject of Good Will is emphasized in the mind of the world, it seems proper to discuss the good will which should and can prevail between the people and utility corporations.
Good will can not be bought or had for the mere asking. It must be deserved and must come as a reward for patient, devoted effort.
We want the good will of every person in this city, and vicinity—man, woman and child.
We can not expect to win active good will in a few weeks or a few months. Within a reasonable time we shall demonstrate our right to the confidence which begets good will.
The people and the Louisville Gas and Electric Company are partners.
Among the tasks to be done in every city those of the public utility organizations are among the most difficult—if not the hardest of all. We transact business every day in the year with the great majority of inhabitants.
Our attitude is that of service in a spirit of partnership; that of wishing every person who pays us a dollar for service, more than a dollar's worth of value in return.
If we succeed in adding to Louisville's growth and prosperity by adequate and low-priced gas and electric service, we shall be glad of the increased individual property values and the increased welfare of individuals.
We realize that we have obligations to the people which can not be ignored. We propose to discharge these responsibilities creditably and always in good faith and good will.
Louisville Gas and Electric Co.
INCORPORATED
GEO. H. HARRIES, President

ADVERTISEMENT SHOWING GOOD-WILL SLOGAN

Illumination and Wiring

Distributing Pole with Self-Contained Transformer

The Commonwealth Edison Company, Chicago, is preparing to make practical trial of a novel distributing pole with self-contained transformer, which is the invention of Mr. E. O. Schweitzer, chief testing engineer for the company. The feature of the design consists in placing a transformer of somewhat cylindrical form in the lowest section of a tubular steel pole, the high-tension leads to the transformer being brought in through the pole, either from below or from above, while a convenient distributing head is provided for the low-tension conductors.



FIGS. 1, 2 AND 3—CROSS-SECTION AND ELEVATION OF STANDARD POLE, AND CROSS-SECTION OF SPECIAL POLE

The general principles of the arrangement are shown in Figs. 1 and 2. Beginning at the lower portion of the figure, it will be noted first that the steel pole is supported in the ground by means of a downwardly projecting pipe which also serves as the inlet for the cables from an underground conduit, if such be employed. The pipe is made an integral part of the pole by means of a metal connecting collar. On this collar rests a low metal table which forms the bottom of an oil-tight container for the transformer.

The transformer is of the shell type and of special cylindrical design. It fits loosely in the pole and is furnished with protecting shields to prevent injury to the coils in handling. Provision is made for submerging the transformer in the oil to a considerable depth to insulate the terminals and to provide ample circulation for cooling purposes. Projecting upward through the oil alongside the transformer is a pipe which makes an oil-tight joint with the table below and which conducts the underground cable above the oil surface where a pot-head is used to fan out the conductors. A loosely fitting horizontal partition located well above the oil surface prevents dirt and small articles from falling into the oil. The lowest pole section contains a door which gives access to the transformer below and to the primary fuse-blocks which are mounted immediately above.

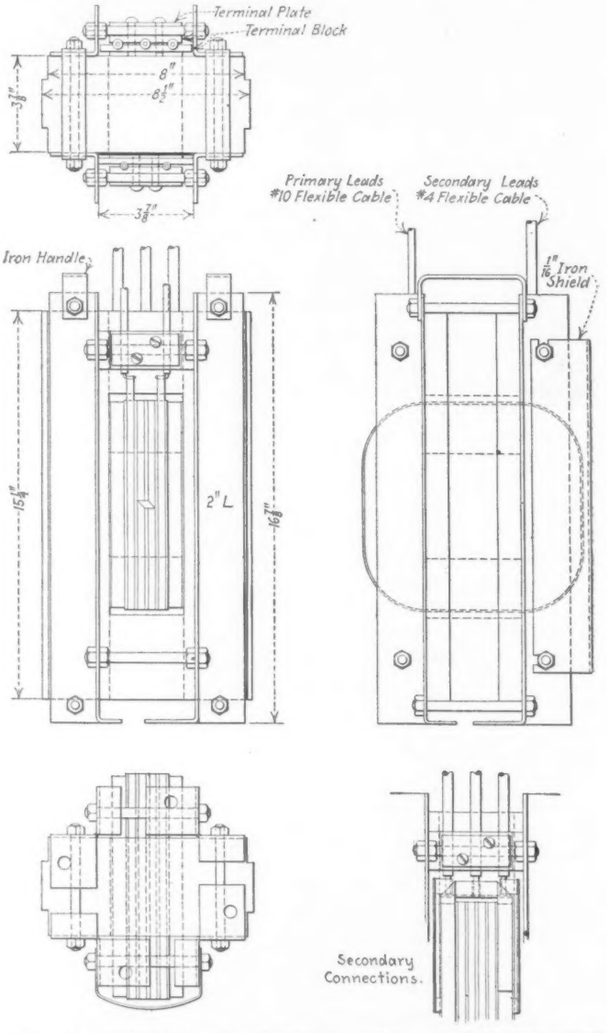


FIG. 4—DIAGRAM OF CIRCULAR TYPE OF TRANSFORMER DESIGNED FOR USE IN POLE

The uppermost section of the pole supports a distributing head consisting of a secondary terminal block of insulating material and a metal distributing ring which supports the radiating secondary conductors. The distributing head is covered with an ornamental cap which furnishes protection from the weather.

The Tubular-Steel Pole

The pole employed is made up of standard steel tubing and differs from the usual type only in having a

somewhat larger lowest section. In a recently designed form, as shown in Fig. 3, the lowest section has a 10.75-in. inside diameter and is made of 0.375-in. steel. This particular pole is intended for all-overhead connections. For simplicity it is set directly in the ground and the bottom plate of the transformer tank is brazed in. The pole-section joints will ordinarily be provided with ornamental rings. It is likely that an insulating lining will be used in at least a part of the pole, to prevent possible grounding through the blowing of fuses.

The opening provided to give access to transformer and fuses is closed by means of a door which is fitted top and bottom with a flange. By means of this the door may be screwed to the pole if desired and with the aid of gaskets the joint may be made moisture-tight.

The Distributing Head

In the pole arranged for overhead distribution the low-tension cables terminate in a hard-maple block as illustrated in Fig. 6. This consists of a cylindrical lower portion which fits snugly into the top section of the pole and a square upper portion upon which the connecting posts are mounted. As shown, the block is provided with three secondary leads for use in the Edison three-wire system.

In Fig. 1 the distributing wires are shown supported in a simple manner by a metal ring. A more elaborate method is illustrated in Fig. 5, where a metal ring is carried on four straps preferably riveted to the top section of the pole. The cables are clamped to the ring

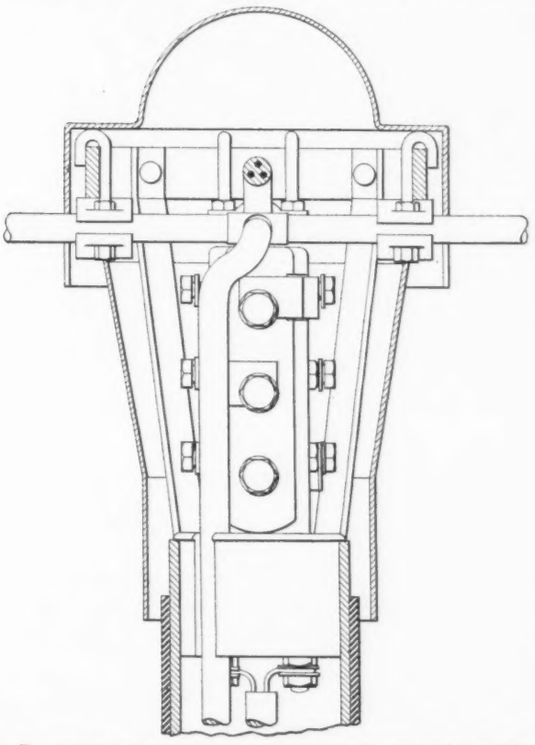


FIG. 5—POLE TOP, SHOWING PROVISION FOR HIGH-TENSION CABLE

by hook clamps. Either type of head described can be readily covered for protection against weather.

The Transformer

The special design features of the transformer for this pole lay in securing a compact, cylindrical form and in the provision of protecting shields and conveniences for handling in the restricted space. A 5-kw transformer is shown in Fig. 4. It is of the shell type with the laminations in the vertical plane. The sheets of the core are clamped together by means of bolts and angle-irons, the latter serving also to form projecting feet to support the core. The two pairs of clamping irons are cross-connected with spacing bolts, the upper pair of which serve to support insulating clamps for the primary and secondary leads. Iron handles are

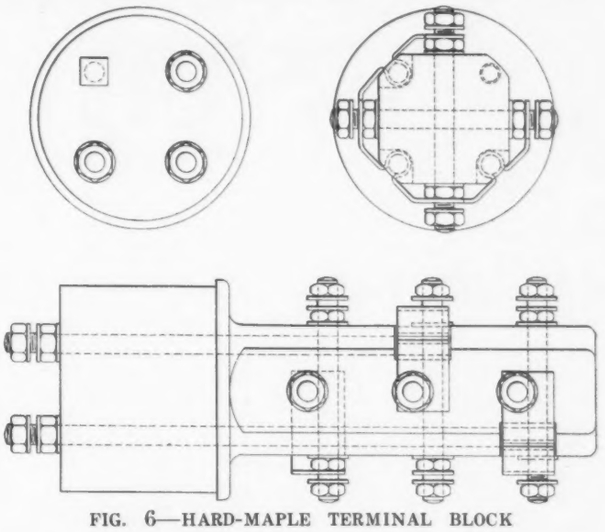


FIG. 6—HARD-MAPLE TERMINAL BLOCK

made by bolting arched straps from angle-iron to angle-iron over the top of the core. The coils are protected from injury by sheet-iron shields.

One of the most interesting features of the design of this transformer is its large output for the given quantity of material. On account of the liberal surface provided by a much greater depth of oil than is usual, the capacity of the transformer is probably 33 per cent greater than it would be were the oil surface but slightly above the top of the core. Not only is the cooling surface large, but the oil circulates well and conveys heat rapidly to the pole shell.

Wiring and Cut-Outs

The primary leads, entering either from below or above, pass directly through the cut-outs which are conveniently reached from the door. When the fuses are removed all apparatus in and on the pole can be handled with impunity. The cables connecting the cut-outs and the transformer can be bent out of the way through the doorway when the transformer is to be removed from the pole, as can also the secondary cable which is secured by a clamp at the top of the transformer pole section.

As compared with the ordinary method of mounting outdoor transformers on poles and walls, the transformer pole described is much more attractive in appearance. It is expected also that the handling of transformers and fuses from the ground will prove more convenient. Such handling is facilitated by the form of the transformer and by its light weight for a given output. For repairs only the core and windings need be removed, whereas with the usual type it is necessary to take down the complete outfit to repair a defective unit. The use of the distribution head is expected to simplify the making of low-tension connections particularly, by rendering it unnecessary for the linemen to climb among the overhead wires for this purpose.

Not the least important among the anticipated savings with the new design is the protection of the transformer from lightning disturbances. The pole forms a grounded protecting shell and will undoubtedly divert most of the lightning discharge to the ground.

Elaborate Temporary Sign and Flasher Installation

To install an elaborate electric sign and outline display on a building for only three weeks' use is rather unusual, but this was done during the holiday season by the Houghton & Dutton Company, Boston, to attract Christmas shoppers to its store. The sign, which represented Santa Claus shooting rockets, measured 24 ft.

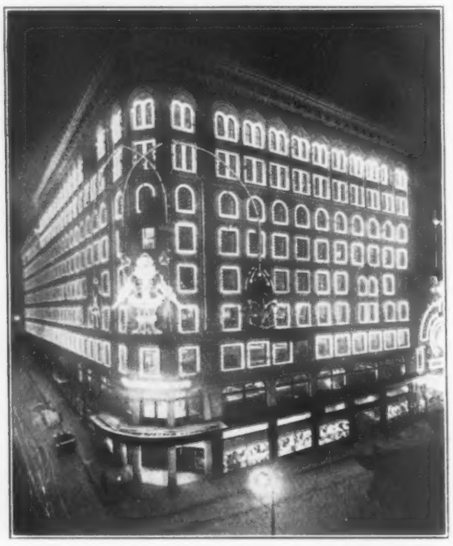


FIG. 1—SIGN FOR CHRISTMAS DISPLAY

high and had a spread of 70 ft. It was made of sheet steel in sections convenient for assembling and, knocked down, was brought to the building on three large four-horse trucks. Two weeks were required to erect the display.

The figure of Santa Claus was placed at the corner of the building, and the strings of lamps representing the streams from the rockets extended along two intersecting walls. When operated, the figure appeared to raise its arms, holding in each hand a rocket, the streams from which shot in opposite directions, each finally bursting into a shower of stars. Below the stars figures of toys flashed into view. On one side appeared a hilarious jumping-jack, while on the other was a rocking-horse. The sign proper contained 1700 30-watt lamps, and its operation was made more effective by the flasher shutting off about one-third of the building outline lamps, of which there were 10,300 30-watt units.

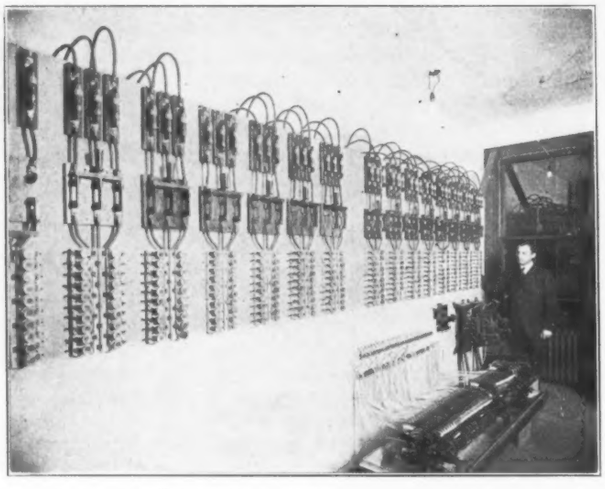


FIG. 2—SPECIAL ASBESTOS-BOARD SWITCHBOARD AND FLASHER

The flashing mechanism, which was unique and necessarily rather complicated, was combined with a specially designed asbestos switchboard on which were mounted sixteen knife switches and 160 fuse plugs. These switches controlled the window outline lamps and a small flasher which, after running one minute, caused a current of 3 amp to close a relay on the large contactor switch. This in turn operated the sign and simultaneously extinguished one-third of the building outline lamps. The total load, which was carried by the Edison Electric Illuminating Company of Boston, amounted to 360 kw. The sign was removed after the Christmas season closed.

Indirect Lighting in the Home

About five years ago Mr. Augustus D. Curtis, president of the National X-Ray Reflector Company, Chicago, read a paper and gave a demonstration of indirect lighting at his home in that city, before the local branch of the Illuminating Engineering Society. The system of shades and reflectors used was somewhat crude, but the subject immediately awakened great interest, and since that time there has been a remarkable development in indirect lighting. This development has, however, been shown to the greatest extent in churches, theaters, club houses, assembly rooms, counting rooms and business offices. Indirect lighting has made comparatively little progress in the home, where the modern movement was begun.

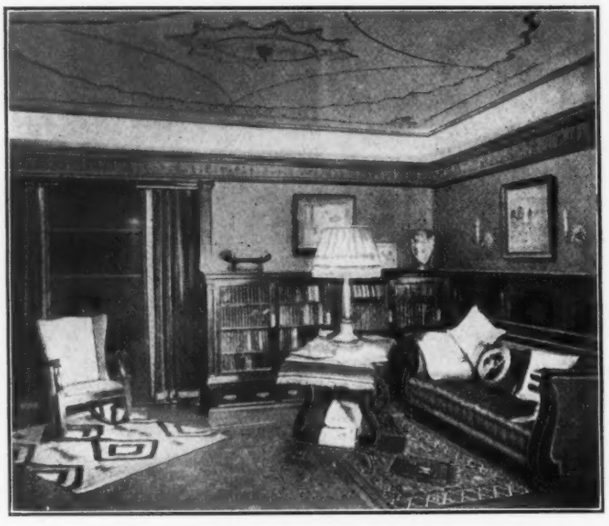


FIG. 1—LIBRARY, SHOWING PORTABLE TABLE LAMP FOR INDIRECT LIGHTING

Recognizing this fact, and desiring to show that progress has been made in this method of illumination for residence lighting, Mr. Curtis threw open his home at 5528 East End Avenue, Chicago, on the evening of Dec. 10 and read a paper before the Chicago Section of the Illuminating Engineering Society on "Five Years' Progress in the Indirect Lighting of the Home." Ladies were invited and a considerable number were present, the total attendance being about sixty-five.

In his paper Mr. Curtis commented on the remarkable development that has been made in methods of indirect lighting during the five years that have elapsed since his original paper. He dwelt on the importance

of reflectors and explained the principle of the so-called "luminous reflectors." He criticised much of the so-called "semi-indirect" lighting and said that the principle of indirect lighting should be preserved and not more than 10 per cent or 15 per cent of the light should be used for ornamental or decorative purposes, which is about the proportion in the case of the luminous reflectors. In some of the semi-indirect lighting fixtures there is a failure to direct the light rays to the best advantage and the bowls are too brightly illuminated.

The earlier meeting at Mr. Curtis' house in 1908 was perhaps the inception of the great movement of the present day for eye comfort and the conservation of vision by concealing light sources. Mr. Curtis added that nearly thirty appliances for indirect lighting have recently made their appearance, and he said that about 100 fixture manufacturers are now putting out indirect-lighting apparatus. He predicted that in many public rooms and elsewhere the use of indirect lighting without ceiling fixtures will be greatly extended. This will be accomplished by the use of pedestals, brackets and cornices, while the backs of settees, tops of bookcases, newel-posts and other interior features of the house can be utilized to conceal light sources.

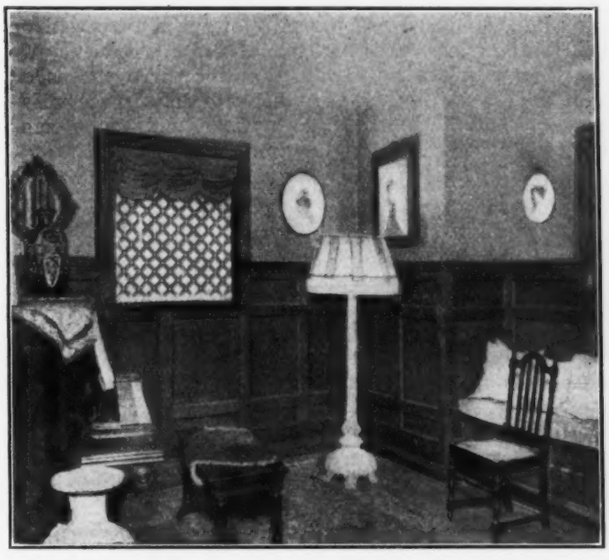


FIG. 2—FLOOR-LAMP ILLUMINATION IN MUSIC ROOM

Mr. Curtis then proceeded to describe the varied and beautiful indirect-lighting fixtures installed in his own home. These are indicated diagrammatically on the accompanying floor plans. Different types of fixtures are used in different rooms, pedestals and portable lamps being employed in the reception room, music room and library, ceiling fixtures in the dining room, bedrooms and bathrooms, bracket fixtures in the halls, etc. The kitchen is the one room where direct lighting is used. An interesting feature is the selection of an indirect-lighting fixture for lighting the porch. Referring to the plan of the second floor, it will be noted that the light intensity in the rear bathroom is much greater than in the front bathroom, although the type of fixture used and the consumption of energy are practically the same in the two rooms. The difference is due to the color of the ceilings and side walls. In the rear bathroom, where white is the color used, the intensity is 2.9 ft.-candles, as indicated on the plan, while in the front bathroom, where the corresponding color is yellow, the intensity is but 1.9 ft.-candles. One pleasing bedroom fixture in Mr. Curtis' house was illustrated in the *Electrical World* of Nov. 1, 1913, page 906.

Dr. M. G. Lloyd, chairman of the Chicago Section, presided at the meeting and in a few introductory remarks pointed out the great progress that has been made in the last five years in all forms of lighting and not in indirect lighting alone. He also referred to the injurious effect of highly calendered paper in causing reflection from artificial light sources and told the

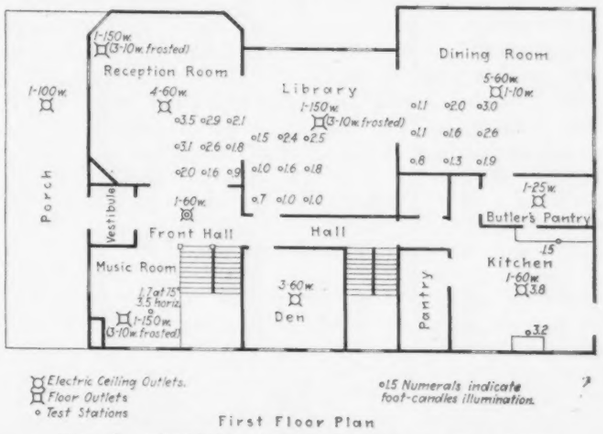


FIG. 3—LIGHTING ARRANGEMENT, FIRST FLOOR

women present that parents should realize the harm that may be done to their children by the use of glossy paper in schoolbooks.

Mr. Albert Scheible, Chicago, said that the opposition which indirect lighting had encountered has been a good thing, as it exposed the defects of the system and caused it to stand on its own merits. He praised the work of Mr. J. R. Cravath, Chicago, as well as that of Messrs. Morgan and Curtis in indirect lighting. In relation to Mr. Curtis' house, he commented on the fact that the interior architectural effects, as in the rounded corners between sidewalls and ceilings, the tinting and the like, are all favorable to indirect lighting. The beautiful effects that the guests saw before them were the results of skilful combination of the work of the architect and the illuminating engineer. Mr. Scheible commented on the absence of much of the "eyebrow shadows" caused by the early indirect lighting. This probably is partly due to getting the fixtures down

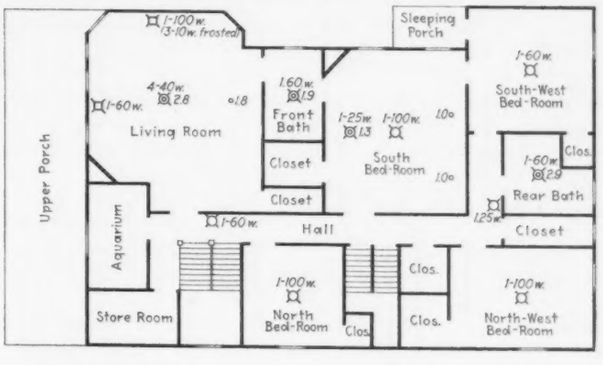


FIG. 4—LIGHTING ARRANGEMENT, SECOND FLOOR

lower, as in the case of pedestal and portable lamps on tables. The speaker wondered whether this tendency for lowering the light sources would continue and whether eventually something like the footlamp lighting of the stage might possibly be provided in the home.

Mr. Irving K. Pond, of Pond & Pond, architects, who, like Mr. Scheible, also attended the meeting five years

before, commented on the development in indirect lighting from floor and portable lamps. As to stage lighting, Mr. Pond remarked that footlamps are being done away with in some of the newer theaters, the lighting effects being obtained largely with side lamps and border lamps. Mr. Pond commended the advancement in the artistic side of artificial lighting. He thinks that indirect lighting has a great future in the home. However, in a drafting room, while indirect lighting is excellent for general illumination, it should be supplemented to some extent by direct lighting over the drawing boards. The general advancement in five years has been in both the efficiency and the charm of indirect lighting.

Mr. James R. Cravath spoke of the importance of the color of the walls and ceilings from which the light is reflected. Great advancement has also been made in so controlling and directing the light from indirect fixtures as to avoid unpleasant shadows.

Several ophthalmologists were present. Dr. Nelson M. Black, of Milwaukee, spoke briefly and was followed by Mr. W. H. Wilder, of Chicago, who said that the movement for indirect lighting is a very important one. Certain eyes are peculiarly sensitive to rays given out by incandescent electric lamps. Perhaps other than light rays may be given off from such lamps. At any rate, the action of strong direct light from incandescent

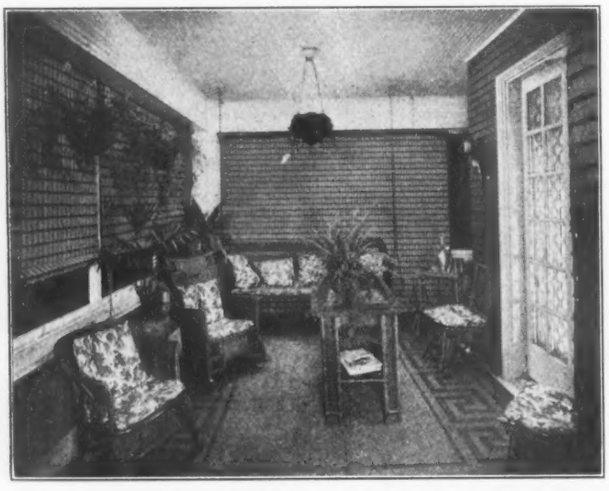


FIG. 5—INDIRECT LIGHTING ON PORCH—BOWL DRAPED WITH FERNS

electric lamps seems to injure the eyes of some people who are particularly susceptible. Possibly a chemical change is made in the visual purple of the eye by some radiation from incandescent electric lamps. The concealment of light sources is obviously of great importance in protecting such eyes. However, the speaker agreed with Mr. Pond that in many cases, as possibly in reading rooms, there should be some method of detail or individual direct lighting to supplement general illumination by indirect lighting. Dr. E. V. L. Brown, secretary of the Illinois Association for the Conservation of Vision and Prevention of Blindness, spoke briefly. Opportunity was given to all present to make an inspection of the lighting features on the two floors of the house.

Recent Telephone Patent

A call-registering system has been invented by Mr. S. D. Williams, of Newport, Wales, in which registration is made both at the exchange and at the subscriber station. At the origination of a call the apparatus is set, but the call can be registered only by the operator. If a call fails, no record is made and subsequent incoming calls may be held without being counted. The counting is so safeguarded that only one registration is possible for each call.

Letters to the Editors

High-Frequency Alternator

To the Editors of the Electrical World:

SIRS:—In an article in *La Lumière Electrique*, Paris, for Sept. 13, as pointed out in your Digest of Current Electrical Literature, *Electrical World*, Nov. 8, 1913, there was given an account of a high-frequency alternator devised by M. Bouthillon, in which he superposes in a conductor a certain number of periodic emfs of equal frequency but with proper phase differences between them, and predicts that the frequency of the resulting emf will be a certain multiple of the original frequency.

I beg to point out that the same principle is described in my British patent, No. 8853, 1911. There the principle is introduced of obtaining either a threefold or ninefold (or any other multiple of three) frequency by starting with a supply emf of either three phases or nine phases (or any other multiple of three), magnifying a certain harmonic in each phase, and finally combining all the effects in a single secondary circuit.

Avondale, Kingsheath, England. A. M. TAYLOR.

The Edison Battery

To the Editors of the Electrical World:

SIRS:—Will you kindly allow me to protest against the statements made by Mr. Lamar Lyndon in his article published in your issue of Jan. 3? Without further comment the reader is likely to infer that the Edison battery is laboring under serious "handicaps" as to first cost and efficiency. Mr. Lyndon's reference to "the excessive current required for their charge" is particularly misleading to the prospective purchaser of an electric vehicle, although it might possibly appeal to the central station selling the energy. As a matter of fact, the actual increase in operating cost resulting from the "excessive" current demand amounts to 1 or 2 per cent—a quantity less than nothing when placed next to any one of plenty of well-known advantages of the alkaline cell in service.

When quality and value demand and warrant it, high first cost is never a "handicap" but rather an advantage. The customer of a high-priced article naturally examines its relative merits with extreme thoroughness and every sale reflects credit on both the buyer and seller. The *Electrical World's* subscription price is three times that of many of its contemporaries, but we doubt if Mr. Lyndon or the *Electrical World* considers this a "handicap." Furthermore, we are quite sure Mr. Lyndon would not recommend to his clients any battery costing one-third the price of the Edison.

Your paper has probably been one of the most potent influences in the development of the electric-vehicle industry. Its consistent and efficient work deserves more support than it often gets. At this time, when the prospects for an immense growth are so bright, commercial innuendoes that tend to befog the enthusiast and prevent the conversion of those who have not yet grasped the opportunities offered by electric traction should be eliminated from its columns. Let 1914 be a

year of boosting. Let those who wish use a battery bought for one-third the price of the Edison if expert attention makes it satisfactory and publish the record of the results as to life, efficiency, maintenance, etc. But for the good of the cause no one should intimate that a battery selling for two or three times as much is not two or three times as good.

ROBERT A. BACHMAN,
Vice-president and General Manager
Edison Storage Battery Company.

Orange, N. J.

The Electrification of Trunk Lines

To the Editors of the Electrical World:

SIRS:—Your editorial of Dec. 27, 1913, entitled "The Electrification of Trunk Lines" I have read with great interest, and I most heartily indorse the sentiment therein expressed, not only in my individual capacity but as an official representative of the Westinghouse Electric & Manufacturing Company.

I should hesitate to address you officially on this subject but for the fact that you state in your editorial that you believe that the art cannot make progress "by the mutual abuse of competitors." As there are only two firms in America which compete for this class of work, of which the Westinghouse Electric & Manufacturing Company is one, it is quite obvious that that company is one of those at which your censure is directed.

I desire to point out that, in common with many others, you hold an erroneous opinion of the position and policy of my company, and to challenge you or any one else to show that my company has ever "abused" a competitor, either directly or indirectly, in an endeavor to establish its position on the question of the proper system to adopt in the electrification of trunk lines or on any other matter.

My company, in developing and exploiting the single-phase system of electric traction, admittedly made a contribution of great value to the electric art. Coincident with the announcement of the development of the system, and especially when it became known that the Westinghouse company had entered into a contract for the electrification of the New Haven road, there began a campaign of misrepresentation and criticism which still continues and which has only one parallel in my experience. By innuendo, by distorted statement and by improper methods every effort has been made to discredit the single-phase development as exploited by my company. About twenty years ago, and by identical methods, the utmost efforts were made to discredit and even to prevent the introduction of the system of distribution by alternating currents which had been brought out and was being advocated by the Westinghouse Electric & Manufacturing Company.

On the occasions when we felt called upon to defend our engineering judgment, especially in the matter of the use of single-phase apparatus on the New Haven road, we were put in the position of apparently advocating the single-phase system as opposed to every other system of electric traction, and for every possible condition of service, notwithstanding the perfectly plain record of my company, which is pre-eminent in railway work, not only in single-phase installations but also in direct-current, 600-volt direct-current, 1200-volt and 1500-volt, and in three-phase applications.

The Westinghouse Electric & Manufacturing Company has electrified more miles of railway under each of the recognized systems than any other company in the world.

While the so-called "battle of the systems" has been raging, with the time-honored method of creating an enemy of straw and then dispatching him with great noise and confusion—wherein my company has been featured as the valiant champion of the straw man and as opposing to the last ditch the development or adoption of high-voltage direct current or any other system than single-phase—we have quietly been filling orders, so that to-day I believe there are more 1500-volt direct-current equipments in operation of Westinghouse manufacture than of any other make.

So with three-phase traction. While our engineering judgment has led us to advise against its use in certain situations, we have strongly advocated it where we believed it was suited, and in the Italian State Railways there exists the greatest three-phase traction installation in the world, and of Westinghouse manufacture.

The truth can never catch up with the lie it seeks to refute, so that some otherwise well-informed engineers are still firmly convinced that the New Haven installation is a complete failure and of small consequence anyway, whereas the facts show that while it constitutes the greatest and most difficult main-line electrification in the world, it is, much to the chagrin of the prophets of evil, a complete success in every particular.

In an editorial, over my signature, in the *Electric Journal* in the issue of October, 1913, I made the following statement:

"For a number of years there has been carried on, in the public press and elsewhere, a controversy which would lead a layman to believe that there was a much wider difference of opinion as to the efficiency of certain systems of electric traction than has actually been the case. As a matter of fact, competent authorities have all along been in substantial agreement and have recognized that most of the problems of steam-railway electrification may be solved satisfactorily in more than one way, while at the same time recognizing that any system which fulfils the requirements of successful operation must of necessity embody certain fundamental characteristics which are well known and appreciated. It could scarcely be expected that railway managers would be unaffected by this controversy on the part of the misguided persons who have been fighting the imaginary 'battle of the systems,' and it would have been natural for them to draw improper conclusions as to the real attitude of those engineers and manufacturers who were and are actually creating and producing apparatus for such service."

This statement is in substantial agreement with your editorial. It is the official opinion of the Westinghouse Electric & Manufacturing Company. The company has taken no part in any "battle of the systems." Its best engineering judgment is at the disposal of its clients and customers. That this is valued and appreciated is best evidenced by the size and quality of the contracts intrusted to it for execution.

The Westinghouse Electric & Manufacturing Company does not need to seek trade by misrepresenting or abusing its competitors. One of the fundamental and cardinal principles of its business is never to run down a competitor's goods. This principle is instilled into every apprentice, every salesman and every employee who has any possible contact with the public, and this has been its policy for twenty-five years.

We object to being included in the category of those who feel it necessary to belittle and misrepresent the accomplishments of others in order to further their own interests.

L. A. OSBORNE,
Vice-president Westinghouse Electric & Manufacturing Company.

East Pittsburgh, Pa.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Changing Lighting Distribution in Detroit from Two to Three-Phase

On account of the increasing demand for motor service in Detroit's municipal buildings, the Public Lighting Commission of that city is changing the municipal electric distribution system from two-phase to three-phase.

At present all of the energy for street and municipal building lighting is being generated at one station by

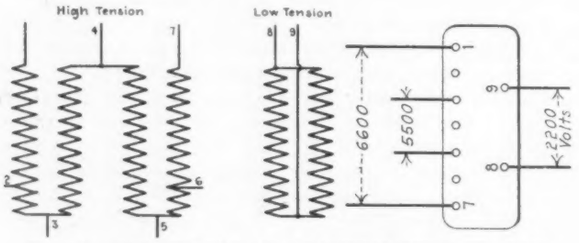


FIG. 1—CONNECTION OF TRANSFORMER WINDINGS

four two-phase, sixty-cycle, 2300-volt alternators having a total rating of 5200 kw. From this station electricity is transmitted at 5500 volts and 6600 volts to five distributing substations. One of these has just recently been completed and is equipped to supply 2000 alternating-current arc lamps, although only 457 are connected now. The rest of the substations distribute energy to 1644 luminous-arc lamps and 2084 alternating-current arc lamps. The transformer equipment of each substation comprises several sets of transformers so that a defective lamp circuit may be isolated from the substation bus.

Thirty-two seventy-five-lamp and one fifty-lamp mercury-arc rectifiers and regulators are installed in the

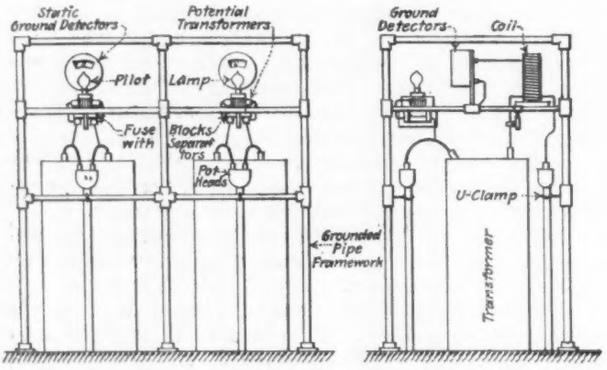


FIG. 2—SPECIAL RACK INCLOSING SCOTT TRANSFORMERS

main station for supplying energy to the direct-current lamps in the immediate vicinity of the station.

To effect the change to three-phase distribution for motor service, Scott-connected transformers will be installed in the substations and energy transmitted to them from the main station at 6600 volts. One substation has already been thus converted and is receiving energy over an underground circuit.

Three-phase energy for motor service in the business district will be furnished direct from the main station by a special Scott-connected General Electric transformer set consisting of two 500-kw units. The accompanying diagrams show the transformer taps used for single-phase and for three-phase distribution, the former being used until the distribution is changed.

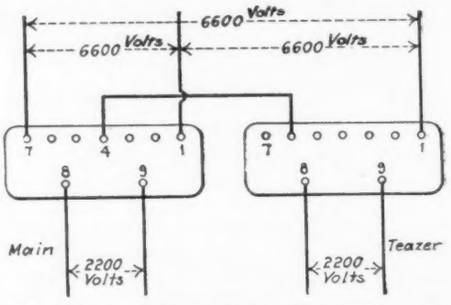


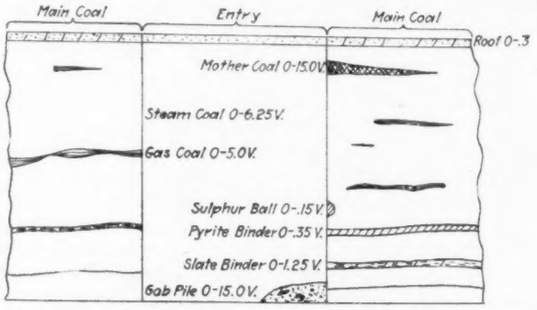
FIG. 3—SCOTT TRANSFORMERS AT DETROIT PLANT

The special transformer set is on the engine floor alongside of one of the 2000-kw turbo-generators. Both primary and secondary leads are carried through lead conduits which emerge from the floor directly in front of and back of each unit as shown in Fig. 2. The conduits rising from the floor, the pilot lamps and the ground detectors are all supported on a grounded-pipe framework built around the set.

Mr. Frank R. Mistersky is general superintendent of the plant.

Ground Currents as Causes of Premature Blasts

In setting blasts in mines the charges sometimes go off prematurely, causing serious injuries to the men who have not had time to withdraw from the workings. A



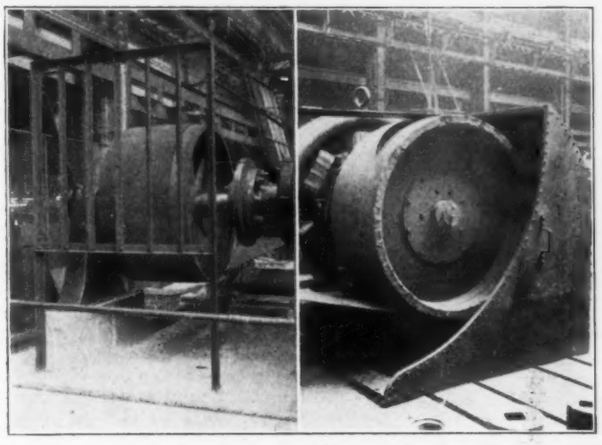
RANGE OF VOLTAGE IN DIFFERENT STRATA

variety of explanations have been given for these accidental explosions, but in an address before the Coal Mining Institute, Pittsburgh, Pa., Dec. 5, Mr. W. F. Edward, Greensburg, Pa., reported his investigations of underground electric currents in the strata and seams of several mines, and suggested that these stray currents may be short-circuited by the ignition wires setting off the blasts. With a voltmeter Mr. Edward found

emfs of 15 volts and higher, although these pressures were transient in character, appearing and disappearing with no apparent regularity. To avoid crosses with ground currents when employing metallic firing needles he urged the use of fibrous or wooden points boiled in paraffine. When using the electric method of firing he suggested that both wires be incased in a common metallic spiral tubing which should extend within a few inches of the coal.

Protection of Moving Belts and Gears

Forms of stationary and portable belt guards in use in the shops of the Westinghouse company at East Pittsburgh, Pa., are shown in the accompanying illustrations. The stationary guard is constructed of pieces of angle iron bolted together, the whole device being fastened in place by means of stay rods attached to the frame of the machine and to the outboard bearing. Supports at the base of the guard are cemented into the floor. By constructing the guard with the intermediate bars arranged vertically a breaking belt will strike at least three of the angle irons, while if the bars were fixed horizontally a condition might arise in which only



FIGS. 1 AND 2—STATIONARY AND PORTABLE BELT GUARDS

one bar would be required to take the entire strain. One angle iron of the size here used would hardly be sufficient to stop a large belt, but three should afford ample protection.

On the test floors the portable belt guard has been found to be a valuable appliance, for in this work all installations are temporary and the men do not always spend the time on belt lacing that they would if the job was to be permanent. Here also the machines are subjected to overloads seldom met in practice, and the belt strains at times reach enormous values. As shown in the illustration, the portable guard is made of heavy-gage sheet steel riveted to an angle-iron frame. Two men at the handles can carry the device easily from one test to another, as occasion arises for changes.

Nearly all of the switches controlling motors and lighting in the plant are now inclosed, one of the most common types of box being shown in Fig. 3. This protector is made of red fiber and is left open at the top so that the handle of the switch can be reached quickly by the machine operator. Instructions are printed on the white card shown on the box. Another style of switch protector in common use is a box made of the same wire-mesh construction as that used in the gear and chain guards in Figs. 3 and 4.

Wherever gears or flexible chain belts are in use on the exterior of machines, protectors made of medium-weight sheet steel or of wire mesh are used.

In connection with the geared machines the inspectors of the safety department often find exasperating conditions prevailing. Recently a large geared lathe was fitted with a complete set of guards at a cost of $340. Soon afterward the entire protective equipment

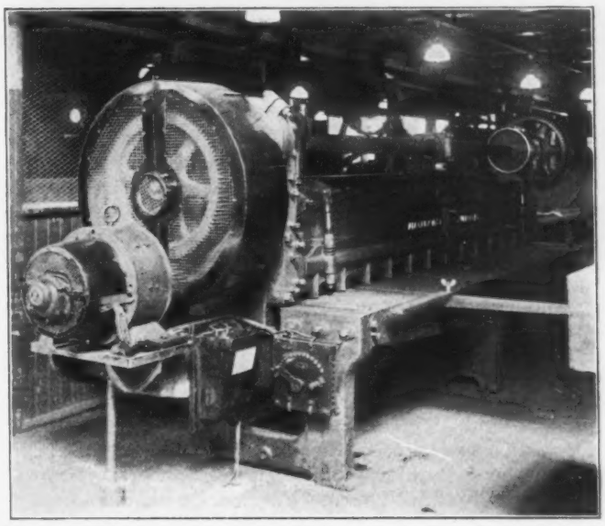


FIG. 3—SAFETY SWITCHBOX AND GEAR CASING

was found on the floor beside the machine with the exposed gears revolving at their customary speed. Investigation showed that after a gear change the operator had considered it unnecessary to replace the protectors.

In another instance sanitary drinking fountains were installed plentifully in the coil-winding room, where a large percentage of the employees are girls. However, the well-meaning sanitary department had reckoned

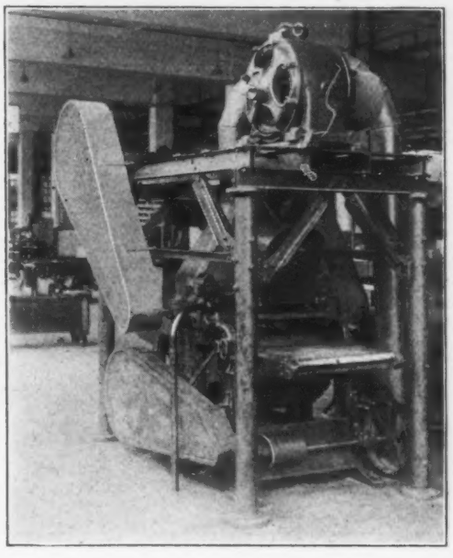


FIG. 4—MESH INCLOSURE OF CHAIN DRIVE

without taking into consideration the feminine viewpoint, and it was soon found that the drinking fountains were not used by the girls for whom they were intended, for the reasons that shirtwaists were splashed (and some complexions injured) on coming in contact with water.

Thus, although good work has been done and is being

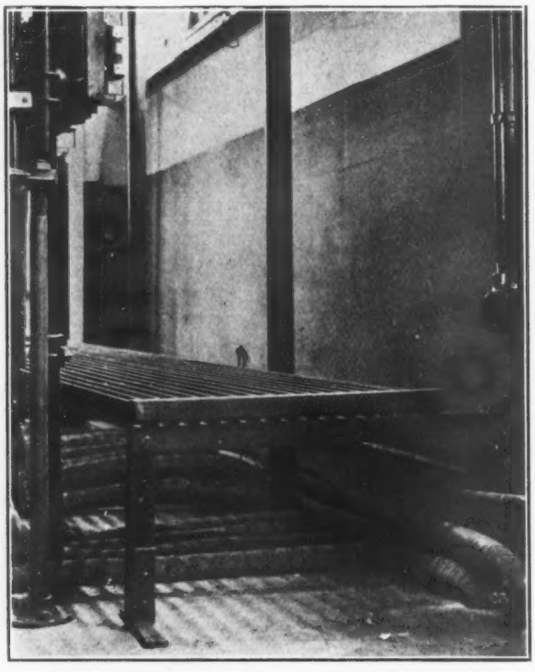
steadily continued, constant and persistent effort is necessary to guard the average workman from the consequences of his own carelessness and indifference.

Electric Crane Aids in Tearing Up Concrete Floor

A concrete floor in the factory of a large industrial plant recently became so irregular after long use that it was deemed wise to replace it with a new surface. Tearing up the existing concrete loomed as a good deal of a problem until one of the company's employees conceived the idea of using the electric crane to raise and drop a heavy piece of iron for breaking up the floor. This skull-cracker arrangement, which proved to be similar to the scheme used for breaking up scrap castings in steel mills, operated admirably, breaking up the concrete and later removing the large pieces much more quickly and easily than it could have been otherwise accomplished.

Safeguarding the Rear of a Switchboard

In an industrial substation originally designed for overhead cable runs at the rear of the switchboard it became necessary to abandon the plan and run the local distribution circuits across the floor to conduit leaving the building at the rear wall. To facilitate safe working behind the board the grating shown in the accompanying photograph was installed. The grating consists of seventeen ¼-in. by 1½-in. wrought-iron bars laid 1½ in. apart on centers and carried at the ends upon a frame built of 2-in. by 2-in. by ¼-in. angles bolted into the wall and floor as shown. The horizontal



SAFEGUARDED PASSAGEWAY BEHIND SWITCHBOARD

bars are supported at five points in the switchboard length of 21.5 ft., and intermediate braces of ¼-in. pipe are provided at intervals of 30 in. The grating affords a walkway 24 in. wide carried 16 in. above the floor, leaving ample space below for the cables and permitting the full use of compressed-air cleaner service, protecting both the operators and the outgoing lines.

Self-Extinguishing Lamps for Stairways

I am equipping a new apartment house with electricity, and a friend who recently returned from Europe has suggested that I install automatic stairway lamps such as are generally used abroad, instead of burning the hall lamps all night long. What kind of switches can I use for this purpose? L. M. N.

In Europe many of the apartment houses are provided with automatic stair lamps which can be lighted by the touch of a button at the bottom or top of the stairs. The lamps burn for two or three minutes, automatically extinguishing themselves at the end of this period. This arrangement gives the late-comer ample time to ascend the stairway (lighting each flight successively if there are several) and it has the advantage of saving the all-night use of the lamps. Such a scheme would, however, be less adaptable to American practice because most cities here have ordinances requiring landlords to operate hall lamps all night long. On the scale of other costs, also, electrical energy is cheaper in this country than abroad, so that less need exists for economizing in kilowatt-hours. The automatic switches used in Germany are based on one of the dash-pot, hot-wire or clock-work principles, the last-named being the one most generally employed. They extinguish the lamps at the end of two or three minutes, after the tenant has had time to reach his apartment if entering, or to pass through the street door if leaving the building. The controlling push-buttons are conveniently placed at each door, where the incoming tenant can unerringly put his finger on them, however dark it may happen to be.

Specific Consumption of Light Sources

State the approximate number of watts per candle-power consumed by the following types of lamps: (a) carbon-filament; (b) graphitized-carbon-filament; (c) tantalum; (d) osmium; (e) tungsten; (f) Nernst; (g) mercury-vapor; (h) Moore tube; (i) open-arc; (j) inclosed-arc, and (k) flaming-arc. P. E. B.

Figures of this nature vary considerably on account of the many different conditions encountered. Incandescent lamps are commonly rated on a mean horizontal candle-power basis and show spherical reduction factors of 0.78 to 0.85. Arc lamps are best rated directly in mean spherical candle-power. The following watts per mean candle-power, as specified, give the approximate ranges of specific consumption for the various types of lamps enumerated:

	Mean Horizontal Cp
Carbon-filament (low voltages)	3.00 to 3.50
Carbon-filament (high voltages)	3.50 to 4.00
Graphitized-carbon-filament	2.50 to 3.00
Tantalum	1.75 to 2.25
Osmium	1.00 to 1.50
Tungsten	0.90 to 1.20
Tungsten (large units, nitrogen-filled)	0.50 to 0.80
Mercury-vapor (glass tube)	0.50 to 0.70
Mercury-vapor (quartz tube)	0.25 to 0.40
Moore tube	1.50 to 2.50

	Mean Spherical Cp
Nernst	1.75 to 2.50
Open-arc (direct-current, clear globes, below 1 watt only with heavy currents)	0.60 to 1.25
Open-arc (alternating-current, clear globes)	0.80 to 1.60
Inclosed-arc (direct-current, multiple, opal inner and clear outer globes)	2.50 to 3.50
Inclosed-arc (direct-current, multiple, opal inner and outer globes)	2.50 to 4.00
Inclosed-arc (alternating-current, multiple, opal inner and clear outer globes)	2.50 to 3.00
Inclosed-arc (alternating-current, multiple, opal inner and outer globes)	2.75 to 5.00
Inclosed-arc (direct-current, series, with clear globes)	2.00 to 2.50
Flaming-arc (series, clear globe)	0.30 to 0.60
Flaming-arc (multiple, clear globe)	0.30 to 0.60

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Mercury-Vapor Rectifier.—K. NORDEN.—An illustrated account of the development of the large-capacity mercury-vapor rectifier of the General Electric Company, of this country, and of the Allgemeine Elektricitäts Gesellschaft. The special feature of the latest design of the latter company is the arrangement of the anodes in such a way that no mercury can be deposited on them (which would interrupt the valve action and produce a short-circuit between the electrodes). For this purpose the anodes are mounted in special side arms outside of the rectifier proper, and the side arms are curved so as to get the anode entirely out of the path of the cathode flame. This construction also permits easy cooling of the anodes. Some data are given on a 100-kw, 300-amp, 350-volt mercury-vapor rectifier. A test at 100-kw load extending over four hours showed a practically constant efficiency of 90 per cent. —*Elek. Zeit.*, Dec. 25, 1913.

The "Cogging" Effect in Induction Motors.—H. L. SMITH.—A note on a paper read before the Rugby Engineering Society. The "cogging" of squirrel-cage motors is due to zigzag leakage and may therefore be expected to be greatest in motors with short pole pitches and small numbers of slots per pole—i. e., slow-speed motors—and least in high-speed motors. Without deleterious results, therefore, the rotor slots for machines with a small number of poles can be larger and fewer in number than for machines with a large number of poles. The practice of making the number of rotor slots incommensurable with that of the stator slots is effective so long as the rotor is central. But when the bearings wear the bulk of the zigzag flux is on one side and the stator develops a "governing" tooth and slot. As every rotor tooth passes the governing slot it is made alternately easier and more difficult for the zigzag leakage to pass, and the rotor tends to stick in the position of minimum reluctance. But the flux in the governing tooth is zero twice in a cycle, and at each of these two instants the rotor is free to move forward one rotor-slot pitch. If the zigzag leakage is bad enough, the machine will continue to run at this peripheral speed of two rotor-slot pitches per cycle. A three-phase, squirrel-cage, four-pole, 220-volt, 0.25-hp motor having twelve slots on the stator—i. e., one slot per pole per phase—and twenty-three on the rotor, with a dispersion coefficient about 17 per cent, exhibited this tendency well. The peripheral speed at synchronism of this machine is eleven and one-half rotor slot-pitches per cycle, and the speed of zero cogging was two rotor slot-pitches per cycle, or 4.23 times that of synchronism, i. e., 260 r.p.m. Owing to the short-circuit current being smaller relative to the normal current than is the case with any ordinary motor, the rotor may be held stationary with full voltage on the stator for quite a length of time without the machine getting unduly hot, or the applied voltage may even be transformed up, when all these cogging effects may be exaggerated.—London *Elec. Eng'ing*, Dec. 25, 1913.

Magnetic Fields.—L. BARBILLON.—The first part of a mathematical paper, illustrated by diagrams, on magnetic fields of various forms and the electromotive forces induced by them. The author first takes up a field varying only in space and not varying in time, and gives the formulas for fields produced by salient poles and for fields produced by uniformly distributed windings. He then takes up the discussion of fields varying both in time and space.—*La Lumière Elec.*, Dec. 20, 1913.

Phase Compensator.—F. NIETHAMMER AND E. SIEGEL.—An article on the phase compensator of Brown, Boveri & Company. The authors first discuss the phase compensator alone by giving a theory of the behavior of a direct-current armature with commutator and brushes, on which a polyphase alternating-current voltage is impressed. The author then discusses the combination of an induction motor with a compensator, the dimensions of the compensator, sparking at the brushes, and the driving and regulation of compensators.—*Elek. u. Masch.* (Vienna), Dec. 21, 1913.

Zigzag Winding Diagrams.—HUMPHRY MACCALLUM. —The author thinks that while a very large number of "series" or "wave" wound direct-current armatures are in use nowadays, this type of winding is not always thoroughly understood. He discusses the subject with the aid of simplified "zigzag" diagrams.—London *Elec. Review*, Dec. 26, 1913.

Heating Dynamo-Electric Machinery. — OSKAR SZILAS.—The conclusion of his illustrated mathematical article on graphical methods for determining the heating of electric machines and transformers. The present instalment deals with transformers.—*Elek. u. Masch.* (Vienna), Dec. 21, 1913.

Lamps and Lighting

Mercury-Vapor Lamp.—BILLON-DAGUERRE.—A note on a water-cooled mercury-vapor quartz-tube lamp with projecting mirrors. The lamp consumes 18 amp at 70 volts, or about 1250 watts, and gives about 3000 cp. The principal feature of the lamp lies in its production of practically "cold" light. For example, this light may fall for any length of time on celluloid, etc., without producing a heating effect on or deformation of the illuminated portion. This feature is especially advantageous for microscopy and photography.—*La Revue Elec.*, Dec. 19, 1913.

Generation, Transmission and Distribution

Combined Mercury-Vapor and Steam Turbine Units. W. L. R. EMMETT.—An article on "power from mercury vapor," the object being to get a much higher efficiency from a turbine plant, operating on both mercury vapor and steam than from a turbine using steam alone. In the present instalment the author gives such data concerning mercury vapor as are required for a thermodynamic investigation of the problem. The process proposed is briefly as follows: Mercury is vaporized in a boiler heated by a furnace of the ordinary type. From this boiler it passes at a pressure near or not much above the atmosphere to the nozzles of a turbine which drives a generator or other load. From this turbine the exhaust is led to a condensing boiler where it is condensed on the outer surface of the tubes, which contain water; this water is vaporized by the heat delivered, and the steam produced is used to drive other

turbines or for any other purpose. This condensing boiler is preferably placed at a level above the mercury boiler so that the condensed liquid will run back into the mercury boiler by gravity without the aid of a pump. Since the mercury vapor is much hotter than the steam, the gases will normally leave the mercury boiler at higher temperatures than those at which they leave a steam boiler. To utilize this excess heat it is proposed to convey the gases after leaving the mercury first through a heater which raises the returning liquid to a temperature near the boiling point; second, through a superheater which superheats the steam delivered by the condensing boiler, and, third, through an economizer which heats the feed water for the condensing boiler and so reduces the gases to the lowest practicable flue temperature.—*Gen. Elec. Review*, January, 1914.

British Power Companies.—The annual statistical tables of British electric power companies with data on equipment, distribution systems and maps.—Supplement to London *Electrician*, Dec. 26, 1913. In an editorial analysis of this table it is pointed out that the tables present the record of a great experiment and of a failure almost as complete. As the results of British legislation, except in a few cases where the local conditions have been particularly favorable, the electric companies have not developed at the rate which their promoters had every right to expect. Many of them are able to operate only small stations, and others are practically moribund. "Altogether this table forms a good example of Dr. Ferranti's recent dictum that when legislation tries to benefit the public the public is nowhere except when it comes to paying." The connections even in such industrial districts as those supplied by the Clyde Valley and Cleveland and Durham companies do not exceed 50,000 kw. This is due to the fact that the pick of the load is in other hands. A striking fact is the number of substations of some of the companies. The Clyde Valley Company possesses 113 substations, with five more under construction, for connections amounting to 43,500 kw, while the Scottish Power Company, with connections amounting to 5000 hp, has no less than forty-two substations under its control.—London *Electrician*, Dec. 26, 1913.

Electric Power for Forging and Stamping Plant.—A note on a paper by W. Spencer before the Rugby Engineering Society in which it is stated that motors driving stamps should be capable of giving the maximum power required at a half-hour rating. For any good motor the output on the half-hour rating will be from 33 per cent to 55 per cent larger than that on the continuous rating. Compound-wound motors are recommended for driving stamps or hammers, since they run at a lower speed as the load increases and are able to stand sudden fluctuations of load. They should be arranged to speed up 20 per cent between the maximum load, calculated from the lifting powers given in a table, and one-sixth of this load. Shunt motors may also be used, but they should be 15 per cent more powerful, as they do not stand fluctuations of load so well. Alternating-current motors may be used, of either the short-circuited rotor or wound rotor types. To obtain the power required for a battery of stamps, the rule is to add together the power required by each stamp separately and to multiply by a factor. These factors are: For two stamps, 0.84; for three, 0.7; for four, 0.58, and for five, 0.47.—London *Electrician*, Dec. 26, 1913.

Panama Canal.—Articles by J. W. Upp on co-operation in the Panama Canal switchboard equipment, by W. Schildhauer on control of the lock machinery, by E. M. Hewlett on centralized control system and power-station switchboards for the Panama Canal, by C. H. Hill and C. T. Hentschel on lock boards and interlocking system, by E. H. Jacobs and H. M. Stevens on the position-indicator system and machines for the locks and on switching, disconnecting and bus arrangement for alternating-current power circuits, by S. M. Mauger and E. Bern on the generation and distribution of power for operating and lighting the Panama Canal, and by W. B. Connolly on the materials used in the Panama Canal switchboards.—*Gen. Elec. Review*, January, 1914.

Electric Power in Sugar Factories.—A. I. M. WINETRAUB.—An article showing the economy of the electrification of cane-sugar factories. From the value of the saved fuel alone and without considering the other advantages, the change-over from steam to electricity in an old mill should pay for itself in three or four years.—*Gen. Elec. Review*, January, 1914.

Steam Turbines.—An article, illustrated by diagrams, on the engineering and commercial development of the Parsons steam turbine during the last twenty-five years.—London *Electrician*, Dec. 26, 1913.

Traction

Electric Versus Steam Traction.—L. CALISCH.—A paper on the economic aspects of electric traction and its advantages over steam. The advantages for suburban service are stated to be high acceleration and retardation and consequently a high schedule speed, more frequent service, increased terminal accommodation, increased earning capacity, greater flexibility in making up trains, and economies due to a cheap supply of electrical energy. These advantages are discussed with the aid of statistical data from British suburban railway practice. As to electric traction on main roads, the chief advantages of handling freight trains with electric locomotives are said to be, first, the hauling of longer and heavier freight trains at higher speeds, and, second, a great reduction in locomotive stand-by losses, which are very high in freight-train service. In England the North-Eastern Railway has decided to electrify its line between Middlesbrough and Shildon, which carries a very heavy ore traffic.—London *Electrician*, Dec. 26, 1913.

Investment Ratio and Operating Ratio.—RENZO NORSA.—Operating ratio is the ratio of operating expenses to operating revenue, but the term "operating expenses" should be clearly defined. Investment ratio is the ratio of operating revenue to investment, and in this case the term "investment" must be strictly defined. The investment ratio and the operating ratio must be considered together in their relation to returns. The author gives two simple diagrams which show how the returns vary with different investment ratios and operating ratios and describes how to apply these diagrams.—London *Electrician*, Dec. 26, 1913.

Single-Phase Traction.—L. GRATZMULLER.—His complete paper with diagrams presented before the joint meeting of British and French electrical engineers on single-phase traction.—*La Revue Elec.*, Dec. 19, 1913.

Installations, Systems and Appliances

German Central Stations.—G. SIEGEL.—A translation of his German article on the economics of German central stations giving statistical data on investment, equipment and development.—London *Electrician*, Dec. 26, 1913.

Regulator for Electric Hot Plate.—In a continuation of the account of the exhibits at the recent instrument exhibition of the London Physical Society, an electric hot plate with automatic temperature regulation is described. It is made of aluminum and the heating elements are of nichrome foil. The method of insuring that a certain maximum temperature (about 250 deg.

C.) on the heated surface shall not be exceeded employs the regulator shown in Fig. 1, the operation of which is as follows: The temperature of the plate may be set at any desired point by turning a contact screw and setting it in the same manner as a micrometer screw. The head of the screw *a* is divided into five parts, each corresponding to 10 deg. C., while the brass tube *b* is divided into five parts, each corresponding to 50 deg. C. In this way, it is claimed, one can always reproduce exactly the most favorable surface temperature (above that of the atmosphere) for any particular operation. The principle of the regulator depends on the difference in expansion between the hot plate itself and a nickel-steel rod. The free end of this rod *h* rests in a socket in a disk *e* which is pivoted about two short pins *g* mounted on the hot plate. To the disk *e* is fixed a brass strip *d* which carries a platinum contact opposite the platinum-pointed end of the regulating contact *c*. When a contact is made between *c* and *d* a circuit carrying a very small current is closed, with the result that a relay actuates a small mercury switch, thus cutting out the heating circuit. When the surface of the hot plate has dropped below the required temperature

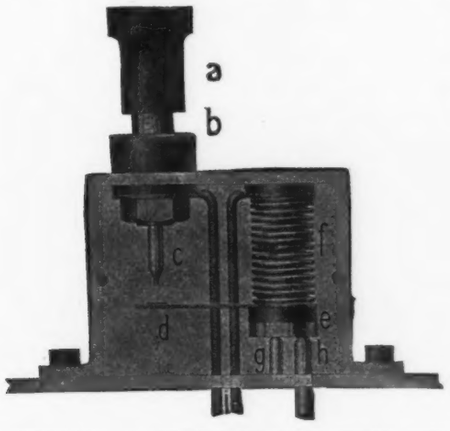


FIG. 1—SECTION OF REGULATOR USED WITH HOT PLATE

the contact between *c* and *d* is broken and the heating circuit is again closed.—London *Electrician*, Dec. 26, 1913.

Wires, Wiring and Conduits

Shackle Insulators.—W. WEICKER.—An illustrated article discussing the advantages of shackle insulators. —*Elek. Zeit.*, Dec. 25, 1913.

Electrophysics and Magnetism

Transmission of Electromagnetic Waves Through and Around the Earth.—G. W. O. HOWE.—In the first part of this article it is shown that a wave in the earth itself cannot persist for any great distance unless it travels through the crust and is continuously supplied with energy from the main wave in the atmosphere above. Long-distance transmission cannot, therefore, be due to waves through the earth. In the second part the received current at great distances, as calculated on the assumption of a perfectly conducting earth and an unionized atmosphere, is shown to be much smaller than that actually found by Austin. This strongly supports the theory of reflection or refraction due to ionization of the upper atmosphere.—London *Electrician*, Dec. 26, 1913.

Geissler Tubes.—MILLOCHAU.—A French Physical Society paper on the laws governing the form of electric discharges in Geissler tubes and the effects produced by these discharges.—*La Revue Elec.*, Dec. 19, 1913.

Electrochemistry and Batteries

Why the Electric Current Passes Through the Interior of a Wire.—J. FISCHER-HINNEN.—Static electricity accumulates on the outside of a conductor. Dynamic electricity in the form of a current passes through the interior of a conductor. The author discusses mathematically why this is so from the standpoint of the theory of static electricity and with reference to the electronic theory.—*Schweiz. Tech. Zeit.*, Aug. 28, 1913; *La Revue Elec.*, Dec. 19, 1913.

Telegraphy, Telephony and Signals

Telegraph Relay and Sensitive Telephone.—With reference to Brown's telephone relay, recently described in the Digest, the present article states that the relay has also been employed to a considerable extent in wireless telegraphy to reinforce the currents at the receiving end. The relay for this purpose differs in some respects in design from the one employed for telephony, but the main principle is the same, the secondary contacts being made by a reed, the tension of which is balanced by a magnet. Mr. Brown has also given considerable attention to the design of a sensitive telephone, particularly for receiving wireless-telegraph signals. Instead of the usual diaphragm, he employs one of conical shape, made of very thin aluminum sheets about 0.002 in. thick, the center of which is fixed to the end of an adjustable reed which is acted on by the receiver magnet. The diaphragm is held in position by a paper or collodion edge. This has the advantage over the ordinary diaphragm that the diaphragm itself is far less rigid and in consequence more sensitive. The natural period of vibration of the system can be adjusted by means of the reed. The arrangement also represents an improvement of the magnetic circuit over that of the ordinary receiver and enables the air gap to be adjusted with accuracy. In place of one central hole in the earpiece, several smaller holes are employed. With these telephones very much smaller currents can be heard than with the ordinary types. Experiments have shown that their substitution for ordinary telephone receivers increases the range of audibility by the equivalent of 5 miles of standard cable.—London *Elec. Eng.*, Dec. 25, 1913.

Telephone Call Meter.—As a result of numerous complaints from telephone subscribers the British Post Office Department has evolved a simple checking meter which can be installed at the subscriber's end of the line. A high-resistance (4000 ohms) electromagnet, entirely copper-clad, actuates a Veeder dial through the usual mechanism. It is connected between the ringing side of the line and earth and is arranged so that as the armature is attracted the circuit of a 1000-ohm resistance in parallel with the 4000-ohm winding is closed, so that an augmented current flows over the line. This current, when augmented, passes through a relay at the exchange, lights a lamp on the switchboard, and so indicates to the operator that the call has been recorded at the subscriber's end. The subscriber's meter is worked by the operator by the same meter key through a relay in the existing cord circuit, which connects an 80-volt battery to the answering relay between the line and earth. The subscriber's meter is not affected by the usual ringing current, as the copper covering of the coil gives it sufficiently high inductance to prevent any considerable alternating current from passing through it. The meter is no more likely to register ineffective calls than the one at the exchange, in conjunction with which it works, and is dependent on the operator to the same extent. The subscriber can, however, immediately notify the exchange if he sees an ineffective call registered.—London *Elec. Eng'ing*, Dec. 25, 1913.

Wireless Telegraphy on the "Imperator."—An illustrated description of the wireless-telegraph equipment of the *Imperator*.—London *Electrician*, Dec. 12, 1913.

Wireless Telegraphy.—The conclusion of the description of the Dubilier system of wireless telegraphy, with some additional notes on wireless telephony. The most important principles of the latter system are the oscillator and the wave-filter circuits. Some notes are added on the condensers employed.—London *Electrician*, Dec. 19, 1913.

Units, Measurements and Instruments

Vibration Electrometer.—H. GREINACHER.—When an alternating-current emf is impressed on a Wulf string electrometer the quartz fibers begin to vibrate and their vibration can be easily detected with a microscope. This fact can be made use of for employing the electrometer as a zero instrument on account of the great sensitiveness with which the electrometer reacts to the application of the alternating emf. It may also be employed as an indicator for electric and magnetic alternating fields, as, for instance, for a system of wireless telegraphy. Fig. 2 shows the latest construction of such a vibration electrometer. Box *G* is closed by the cover *D*, to which is firmly attached the electrometer system, so that the latter can be removed together with the cover *D*. The electrometer proper consists of a metallic rod *S*, to which is welded the vertical strip *L*. Opposite this is a fine platinum wire *P* so that the distance of the strip *L* from the platinum wire is about 1 mm. The platinum wire is connected at its upper end with the cover which bears the terminal *K*, while

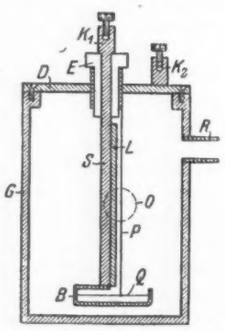


FIG. 2—SECTION OF VIBRATION ELECTROMETER

the metallic rod *S* is connected to the other terminal *K*. The lower end of the platinum wire *P* is fastened to an insulating horizontal quartz fiber *Q*, stretched between the ends of the bow *B*. The alternating emf is applied to the terminals K_1 and K_2. The vibration of the platinum wire is observed through the opening *O* in the front wall of the box. A corresponding opening in the back wall serves for illuminating the wire with a mirror.—*Elek. Zeit.*, Dec. 25, 1913.

Book Reviews

EINFUHRUNG IN DIE ELEKTROTECHNIK. By Otto Nairz. Leipzig, Germany: Johann Ambrosius Barth. 415 pages, 351 illus.

An elementary electrical-engineering textbook for students in technical colleges. It contains much original matter arranged in somewhat unusual order. The chapters into which the work is divided relate to the following subjects: The magnetic field; the electric field; electric current; the electromagnetic field; the absolute system of units; thermal applications; chemical actions of the current; electrochemical actions; magneto-mechanical generators; variable currents; single-phase alternating currents; the influence of iron on the alternating-current circuit; transformers; the generation of single and polyphase currents; energy transmission; and radio-frequency oscillations. The treatment of the subject-matter is essentially electrotechnical and didactic, the demonstrations being partly algebraic and partly geometric. The last chapter on oscillatory-current circuits is particularly good. The book will interest not only students of electrical engineering acquainted with the German language but also teachers of electrical engineering interested in comparing their methods with those of German colleagues.

RECENT PHYSICAL RESEARCH. An account of some recent contributions to experimental physics. By David Owen. London: England: *The Electrician* Printing & Publishing Company, Ltd. 156 pages, 53 illus. Price, 3s. 6d.

In the preface of this very entertaining book the author pertinently remarks concerning the rapid contemporaneous advance of physics: "The textbook, even when fresh from the press, is perhaps necessarily several years behind the wave-front of advancing knowledge." This is another way of saying that he who stops to record and present the acquisitions of physicists must necessarily allow the advance guard to pass him by. The book seeks to present to those interested in physical research the more recent advances which have been made and which have not yet had time to filter into textbooks. The thirteen chapters of the book relate to the following topics: Positive rays; Rutherford's work on the alpha particle; Curie's work on magnetism; the aurora; Brownian movements; the pressure of radiation; short electric waves; free electrons in metals, and magnetic bodies composed of non-magnetic elements. The treatment of the subjects dealt with is very skilful. They are presented forcefully and clearly with the minimum of extraneous material or unnecessary mathematics. The result is very interesting reading to the interested physicist. The book will attract students of physics and scientific readers generally.

HANDBOOK OF ENGLISH FOR ENGINEERS. By Wilbur Owen Sypherd. New York: Scott, Foresman & Company. 314 pages, illus. Price, $1.50.

This little volume will be of real service to embryonic technical writers and young engineers who are face to face with their first reports or letters of application or of recommendation. Although written primarily for the foregoing and to serve as a practical textbook of English for engineering students, it also serves as a handy reference book to older members of the profession who find that their inability to write clearly and concisely constitutes a stumbling block to advancement and greater achievements. As a handbook for engineers it is practical in every respect, containing as it does numerous quotations from current technical papers and magazines and engineering reports. Its pages include, in fact, examples of practically every kind of writing that the young engineer or student may be called on to do. The book is divided into five chapters and two appendixes. Chapter I covers the general problem of engineering writing, including the planning and presentation of technical papers and the uses of paragraphs, sentences and words. Chapter II deals with the mechanical details, giving rules for using abbreviations, numbers and capitals and for hyphenation and punctuation. Chapters III, IV and V contain respectively numerous examples of letters, reports and technical articles. In Appendix A are given directions for proofreading, while material for criticism, consisting of faulty paragraphs and sentences, is presented in Appendix B.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Weatherproof Locking Sockets

The weatherproof, keyless socket shown herewith is the product of the Pass & Seymour Company, Syracuse, N. Y., and is included among the "Shurlock" sockets already manufactured by the same company. The socket is made of mica compound. A recessed locking

WEATHERPROOF KEYLESS SOCKET

screw, which can be removed with a key that fits over its triangular head, is forced against the base of the lamp. The end of the screw is pointed and locks the lamp securely in the socket.

Light Electric Delivery Truck for Breweries

The Baker Motor Vehicle Company, Cleveland, Ohio, is putting on the market a light delivery truck for the use of brewers in handling bottled goods in small towns and in the residence districts of large cities.

The body is neat in appearance, as shown herewith, and it has a loading space 106 in. long, 46 in. wide and 60 in. high, carrying fifty-four beer cases of twenty-four bottles each per load. The cases are arranged in two rows, nine cases long by three tiers high. The side panels of the body are made of two sliding doors, each one-half the length of the body. No opening in the rear is provided. The doors slide on roller bearings on an overhead track which is always free from dirt. Each

DELIVERY TRUCK FOR BREWERY

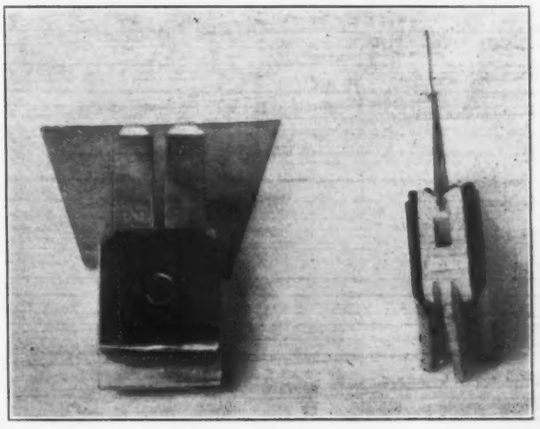
door has a spring lock which cannot be opened without a key. By using this system of doors the driver can take out any case of bottles without disturbing the rest, an arrangement which saves considerable time. The floor of the body slants toward the center on each side, thus preventing the cases from sliding against the doors and making it hard to open them.

Similar types of bodies have been displayed to handle full loads of 2.5 tons (ninety standard cases) and 4 tons (145 standard cases) of bottled goods.

Repulsion Fuse

The fuse shown in the accompanying illustration, which has been developed by the Metropolitan Engineering Company, Brooklyn, N. Y., consists of constricted zinc ribbons bent in the shape of a U over a thin mica separator. The constrictions are at the bend and at the end of the separator so that upon rupture due to overload the fuse is broken in two parallel strips of equal length, one on either side of the separator, and each with its upper end free.

Since the current in the parallel legs of the U flows in opposite directions, a force of repulsion is exerted



REPULSION-TYPE FUSE

between the two. The ends of these legs are fixed, but after fusion the ruptured ends are free and maximum movement is possible at the ends where the arc occurs.

The force actually resulting is considerable and can, for any definite condition, be calculated from the formula.

$$F = \frac{4\pi I^2}{100\,d} = \text{dynes per centimeter,}$$

where d is the thickness of the insulated separator, and I is the current flowing.

A 60-amp fuse, by calculation from oscillogram records, would, under short-circuit conditions, generate a repulsion force (F) as great as 190 lb.

The greater the overload the more widely the fused ends become separated, resulting in a prompt suppression of the arc.

In addition to the fundamental principles of repulsion, two other principles are utilized, namely, the magnetic blowout and a tendency of the metallic vapors produced at the rupture to force the limbs of the fuse apart.

The magnetic blowout is quite noticeable at moderate

overloads but is masked by the repulsive effect at great overloads. The effect of the expanding gas has been traced in some tests but is not a very important feature.

The complete fuse consists of a porcelain fuse holder, an insulating barrier, a fuse element and copper contact plates.

Electric Hammer

An electric hammer for tracing, lettering and carving stone and for other light work has been developed by the American Electric Tool Company, Petersburg, Va. The regulating mechanism is contained within the grip or nose of the hammer. By twisting the grip to the right or left the plunger can be caused to strike light or hard blows as desired. The operation of the Paulero electric hammer, as this tool is called, is automatic. The hammer is worked by inserting a chisel or other tool in the socket and pressing it against the work. Only the natural pressure of the hand to keep the tool in place is necessary, and as soon as the device is lifted away from the work, thus relieving the pressure, the energy supply is cut off and the hammer stops immediately. The casing of the hammer is made of aluminum, and the regulating mechanism, the plunger, the tool socket and other parts subjected to wear are of hardened tool steel. When in action the plunger strikes 1800 to 2000 blows per minute.

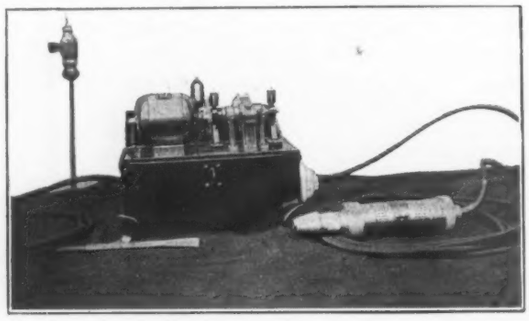


FIG. 1—COMPLETE EQUIPMENT FOR DIRECT CURRENT

The magnet coils for the hammer are wound directly on a single-piece brass spool. The wire used is insulated with enamel and will withstand a temperature of more than 500 deg. Fahr. All electrical parts are thoroughly insulated from the frame. The hammer is equipped with the necessary apparatus for operating from direct-current or alternating-current lighting circuits at pressures ranging from 110 volts to 250 volts. Fig. 1 shows a complete outfit for direct-current operation, consisting of hammer, commutating switch and all necessary cable connections. In Fig. 2 is shown the equipment for alternating-current work. A small motor-generator set with commutating switch is provided. The motor-generator set is small, taking up scarcely 14 cu. in., and can be placed on a shelf out of the way of workmen.

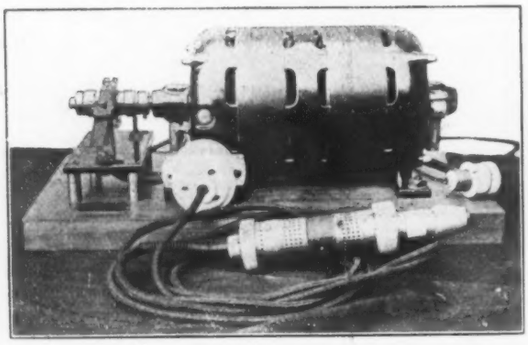
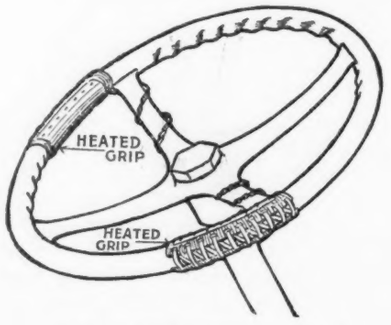


FIG. 2—COMPLETE EQUIPMENT FOR ALTERNATING CURRENT

Electrically Heated Wheel Grips for Motorists

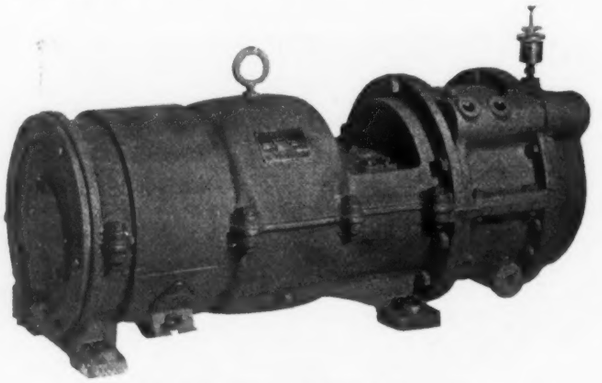
To avoid the objections to winter motoring caused by numb hands, electrically heated grips for steering wheels are being manufactured by the Motorist's Warm Grip Company, Marshall, Tex. These heated grips may be laced onto the steering wheel rim and are heated by energy from the battery or low-tension magneto. The consumption of energy is low, being about one-half that required for one pair of electric head-lamps. Flexible cords wound around the spokes of the wheel connect the grips with the battery and switch, which may be fastened to the dashboard.



ELECTRICALLY HEATED GRIPS

A 1-kw Turbo-Generator Lighting Unit

To provide electric light for limited areas where steam is available but suitable electric motor service is not, such as in the case of contracting operations, in small industrial plants, on steam launches, etc., the Westinghouse Electric & Manufacturing Company, Pittsburgh, has recently put on the market a small turbo-generator which will operate an arc lamp and a few incandescent lamps, or about forty 25-watt tungsten lamps or their equivalent. The unit is very compact, being only 3 ft. long and 1.5 ft. high, and it can be installed wherever provision is made to keep it horizontal. Little attention is required for its operation, and all parts are easily accessible.

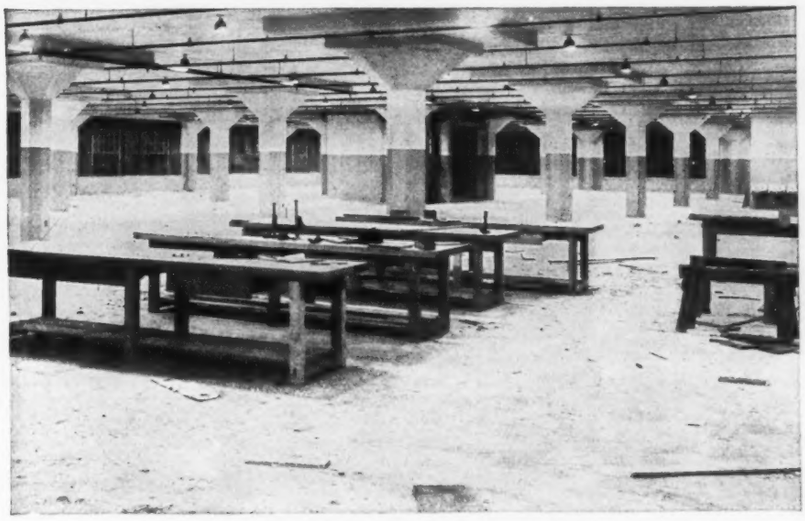


TURBO-GENERATOR FOR LIGHTING

The turbine and generator are mounted on the same frame. The turbine is of the impulse type and has a governor which keeps the speed uniform for all variations of load and steam pressure. The full rating of 1 kw is developed on 90 lb. steam pressure, and satisfactory operation can be obtained with pressures up to 250 lb. The weight of the unit is 283 lb. The rated pressure of the generator is 120 volts.

Lighting of Automobile Service Station

The Ford Motor Company is using 100-watt clear-bulb tungsten lamps to illuminate the interior of its new service station at San Francisco, Cal. The arrangement shown herewith is typical of the floors above the first or garage floor, four units, fastened at the ceiling, being allotted to each bay. The first floor has a higher ceiling than the other floors, which permits the use of a large lamp in the center of the bay.



LIGHTING OF AUTOMOBILE SERVICE STATION

The bays shown in the illustration are 25 ft. by 28 ft., making the power expenditure 0.57 watt per sq. ft. The height of the ceiling is 12 ft. 2.5 in., and each reflector is suspended so that the bottom is 11 ft. 5.5 in. above the floor. The ceiling is white and the floor is of concrete. A photometric test showed that the average intensity for this floor is 4.13 ft.-candles.

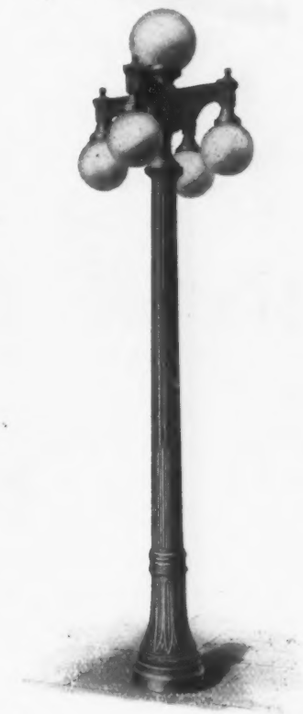
The reflectors are made of glass in one piece and are covered on the outside with a coating of silver which is protected by a green elastic backing. A fire glaze is given to the inner surface. These reflectors are known as the X-Ray beehive reflectors and are manufactured at the plant of the National X-Ray Reflector Company, in Chicago, Ill.

Magnetic Separators in Rubber and Steel Plants

Removing iron particles from ground scrap rubber in the reclamation plant of a rubber mill and extracting the metallic iron from crushed slag in a steel plant are two new applications recently found for Cutler-Hammer magnetic separators. The separation is effected by simply passing the ground or crushed material on a belt over the magnetized pulley which picks out the metallic particles and allows the remainder to be cast forward to a conveyor or chute.

Cast-Iron Lamp-Posts

The Central Foundry Company, 90 West Street, New York, has developed a new line of cast-iron lamp-posts for arc and incandescent lamps. In the illustration is shown a five-lamp standard, one lamp, with a globe 16 in. in diameter and an 8-in. fitter, being upright in the middle, and the other four, with globes 12 in. in diameter and 6-in. fitters, being inverted from horizontal arms. The shaft, which is fluted, is 10 ft. 3 in. high and has a diameter of 6 in. at the top. It is fastened to the base by four ⅞-in. bolts. The diameter of the bolt-hole circle is 20 in.



FIVE-LAMP CAST-IRON STANDARD

A threaded nipple is provided for fastening the upper part of the standard to the shaft. Threaded nipples are also used for fastening the lamp fitters. The overall height of the standard is 13 ft. 6 in.

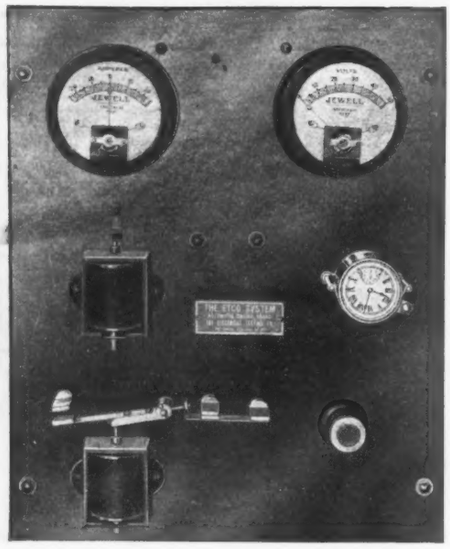
Farm-Lighting System

A lighting system for farm use, consisting of a storage-battery lighting plant with an automatic switchboard, which is illustrated herewith, is being put on the market by the Electrical Testing Company, Peoria, Ill. As the generator is nearly always belted to a large gasoline engine, which is doing other work, the plant is not designed for self-starting on account of the unnecessary draft which this would put on the battery.

In operating a plant of this kind it is first necessary to start the engine; then the automatic switchboard connects the battery on charge and throws the balancing cells in series with the lighting circuit to maintain the proper voltage. When the battery becomes fully charged the cut-out acts, and the charging is discontinued. This action does not stop the engine, but a small time switch in the ignition circuit can be set so as to shut down the engine at any time. In nearly every case the engine can be working while the battery is being charged. If the battery should become fully

charged, it will be automatically cut out, and the engine will continue to work until shut down.

Owing to the automatic features it is not necessary to install the plant entirely in one place. The generator

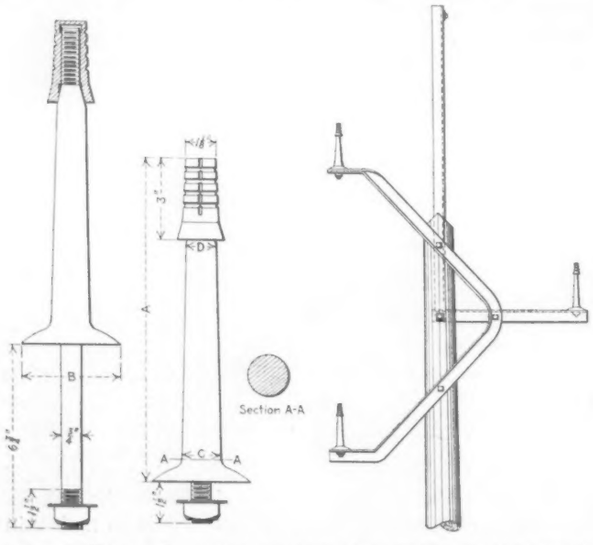


AUTOMATIC SWITCHBOARD

can be installed in a shed or shop with the engine, the battery in a basement and the switchboard in any convenient place available. Steady light can be obtained from the generator while the batteries are on charge. Any style of gasoline engine can be used with this type of equipment.

Forged-Steel High-Tension Pin

Messrs. Hubbard & Company, Pittsburgh, Pa., are putting on the market a forged-steel pin of the center-bolt, separable-thimble type for supporting high-tension



FIGS. 1, 2 AND 3—LONG-SHANK AND SHORT-SHANK PINS, AND PINS USED ON ANGLE SECTIONS

insulators. The pin is made in two styles, that shown in Fig. 1 with a long shank for wood or channel-steel arms and that in Fig. 2 with a short shank for arms of angle section similar to those shown in Fig. 3. The tapered collar of the thimble, which is made of malleable iron, greatly reinforces the pin at its smallest diameter. This thimble can also be used with high-tension steel clamp pins for wooden and steel angle arms and various kinds of pole-top pins. The pin is furnished either plain or galvanized.

Dial-Type Laboratory Wheatstone Bridge

The dial-type of resistance apparatus has the advantage of being easy to manipulate, and as there are no loose plugs, possibility of delay or inconvenience which might follow the loss of any of the parts is avoided. The unit-type Wheatstone bridge, as it is called, which is illustrated herewith, is for use in laboratories and is similar in construction to a portable instrument described in the *Electrical World* of April 26, 1913. Boxes are made with two, three or four dials.

All coils are wound on metal spools, thus preventing the resistance values of the coils changing on account of variations in the dimensions of the spool, as may happen when wooden spools are used. A new decade

LABORATORY WHEATSTONE BRIDGE

arrangement is used by means of which all resistance values are obtained by combinations of five coils. Each decade, consisting of five resistance spools, a dial switch and mounting, is made up as a separate unit. The dial contacts are all mounted within the box and are therefore protected from dust and dirt. The contacts are inverted so that should dust get into the box it cannot gather on the contact surfaces. All the parts, however, are easily accessible for cleaning. The switches are made of three leaves of phosphor bronze, each having an independent bearing on the contact plates. The ends of the switches are bent so that they do not lie tangent to the path of travel, and the possibility of wearing rings in the plates is, therefore, eliminated.

A ratio-control arrangement is used for this Wheatstone bridge by means of which one dial controls both bridge arms. When making a measurement the rheostat value, when a balance is obtained, is multiplied by the ratio-dial setting. The values of these multipliers are 0.001, 0.01, 0.1, 1, 10, 100 and 1000.

These instruments, which are inclosed in well-finished mahogany boxes, are manufactured by the Leeds & Northrup Company, Philadelphia, Pa.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Exporting Electric Ranges to South America.—In a recent conversation with a representative of the *Electrical World*, G. A. Hughes, of the Hughes Electric Heating Company, Chicago, remarked that the electric-range business is in a satisfactory condition at the present time. The export sales of the company to South American buyers have been especially encouraging, one carload of stoves having been shipped within a few days to points in the southern half of the continent.

Electric Vehicle Growth in New York City in 1913.—According to the records of the Automobile Bureau of the New York Edison Company, the increase in the number of electric vehicles in use in New York City during 1913 was 479, or an average monthly increase of about forty cars. The greatest increase was recorded in April, when seventy-two new cars were registered, and the lowest figures were shown for January, when but four additions were made. The energy consumed by these additional vehicles is estimated at about 3,178,000 kw-hr. per annum.

Incandescent Lamp Importers Look for Good Business Under New Tariff.—Deuth & Company, of New York, recently gave out a statement on the incandescent-lamp outlook from the importer's point of view which was marked by an apparent feeling of optimism concerning the future of that business. According to E. J. Deuth, of the above company, the indications are that the year 1914 will produce a larger volume of business in that line than did 1913. He states that there is a large and growing demand in this country for high-grade tungsten lamps of foreign make and that the imports of these lamps are increasing rapidly.

Company to Make Industrial Trucks.—The Electromobile Company, of St. Louis, Mo., was organized recently with a capital stock of $100,000 to manufacture small industrial electric trucks for use in factories and shipping houses and on steamship docks where materials and packages are to be conveyed only a short distance. Sanford J. Bernheimer is the organizer, and Ralph Kalish, patent attorney, is secretary and treasurer of the company. The truck, which is designed for a load of 2000 lb., can exert a tractive effort of 5000 lb. to 8000 lb. The total length of the truck is 8 ft., all of which is loading space except 1 ft. devoted to the operator.

Quicksilver Production Low in 1913.—According to the preliminary figures of the United States Geological Survey, the domestic production of quicksilver in 1913 was 19,681 flasks of 75 lb. each, with an estimated value of $774,054. These figures are stated to be the lowest since 1860. There has been a gradual decline in the market price of quicksilver since 1910. Exports of the metal in 1913 amounted to approximately 82,442 lb., valued at $41,722, a marked increase over the figures for 1912. Imports during 1913 are estimated at 152,375 lb., valued at $66,943, also an increase over the corresponding figures for the previous year.

No Concentration of Lamp Factories Contemplated.—A rumor to the effect that the National Lamp Works of the General Electric Company were planning to consolidate their twenty-five factories throughout the country into one large plant at Cleveland was emphatically denied by F. S. Terry in a statement recently to an *Electrical World* representative. Mr. Terry said that such a plan would be exactly the opposite of the company's set policy of distributing its factories as widely as possible consistent with economical operation. He said that it was desired to make the lamps as near to the consuming market as possible, both as a question of economy in transportation and as a matter of policy. The several lamp companies under the control of the General Electric Company are on a quasi-competitive basis at the present time, each having its own production and sales forces as well as a separate management. The most important point in which they act in combination is in the engineering research work, carried on mainly in Cleveland, which is on too large a scale to be practicable for one company.

Recent Large Boiler Sales.—The last report of the Babcock & Wilcox Company, of 85 Liberty Street, New York, on the larger of its recent boiler sales shows an aggregate of 28,000 hp in installations of over 1000 hp. The Norfolk & Western Company took the largest single order recorded, 6770 hp, for its Bluestone (W. Va.) plant, and the second largest order was placed by the Commonwealth Edison Company, of Chicago, for 6100 hp for its Northwest Station in that city. C. C. Moore & Company have ordered for the Mount Whitney Power & Electric Company, of Visalia, Cal., 1809 hp in steam boilers of the same make. The other sales were for use in industrial plants or in public buildings.

Louisville Manufacturer Installing Motor Drive.—The Bills Mirror Plate Company, Louisville, Ky., which has been using electric motors for the operation of its special machinery for several years, recently had a fire which destroyed practically its entire plant. In rebuilding, the company had occasion to decide whether or not to continue the use of electric power and central-station service, and promptly determined to do so. It has contracted with the Louisville office of Fairbanks, Morse & Company for the installation of ten motors, with an aggregate capacity of 75 hp. and will continue to use current furnished by the Louisville Gas & Electric Company. The Bills company maintains a boiler plant, but this is only for heating purposes, hot water being needed for its manufacturing operations.

Foreign Markets for American Electrical Equipment.—In Denmark, Norway and Sweden there is an increasing demand for electric elevators of the automatic push-button type, with a capacity of three or four passengers. This type of car and control seems to be favored, whether there is an operator or not. Both alternating and direct current at voltages of 110 and 250 are common. In Budapest, Hungary, there is a preference for American-made wiring supplies, but the Austrian and German manufacturers practically control the market. The goods of the latter have gained a foothold because of their comparative cheapness and because longer credit is given by them than is customary with American manufacturers. On a basis of quality the American goods can generally resist competition. American manufacturers who wish to enter this territory will generally have to send their own agents, as the contracts of the local selling agents with manufacturers of other countries nearly always forbid the sale by them of American-made goods. Electrical goods are sold generally on a credit of four to six months and payment is seldom made within three months. In the cities of Mersina, Tarsus and Adana, in Asiatic Turkey, there are a number of factories and other enterprises using electric energy, and American electrical supplies have not yet been introduced. China is largely dominated by the British and German interests and little electrical material of American make is sold, although American wiring standards are used in many cases. Such trade as there is seems to be handled through the local importing houses, rather than direct or through branch offices. A 230-volt, direct-current, three-wire, earthed-return system is largely used for operating fans and electric lamps in Bombay, India, although in the suburbs of that city there is 230-volt alternating current available. Most of the wiring is open, carried on cleats, but in government buildings some steel-armored conduit is used. There are a number of native dealers in electrical supplies in Bombay, and many of them claim to be electrical engineers. The result is that a

highly competitive condition exists and a strong tendency has been manifested to turn to the cheapest grade of goods in order to secure the limited trade possible. At present a large part of the electrical goods sold there are of British manufacture.

Ford Motor Company Orders Novel Engine Equipment.—Contracts have been placed by the Ford Motor Company, of Detroit, Mich., for an electric generating plant which will contain some distinctly novel features. The object of the new station will be to provide a means for utilizing the heat ordinarily wasted in the operation of a producer-gas-engine-driven generator. In the proposed plant four Hamilton Gray engines built by the Hooven-Owens-Rentschler Company, of Hamilton, Ohio, will be used to drive the same number of 3750-kw, 250-volt engine-type direct-current generators of Crocker-Wheeler make. The plan view of one of the new engines will resemble that of a cross-compound steam engine, with two cylinders in tandem on each side. One pair of these cylinders will be operated by producer gas and the other by steam. The feed water for the boiler supplying the steam cylinders, will be carried through the water jackets of the gas engine and then further heated by the exhaust gases from the latter and by waste heat from the producer gas plant. The difference in characteristics between the gas and the steam-engine cylinders will be compensated by the use of a heavy fly-wheel. The generators in these units will be designed for much higher efficiencies than are usual in commercial installations. Full-load efficiencies of over 94½ per cent are predicted. The utilization of waste heat for preheating of the boiler-feed water is expected to make the plant a very economical one. In order to facilitate the transportation of the generator armatures from Ampere, N. J., where they will be built, to Detroit, where they will be finally assembled, the split form of construction will be used.

Statement of the Copper Producers' Association for December

On Jan. 1 the stock of copper on hand in the United States exceeded 70,000,000 lb. for the first time since April, 1913. This rise from low-record figures in three months has resulted from a marked reduction in the domestic consumption, in spite of a general increase in foreign deliveries. Production seems to be reaching a more uniform basis, as shown in the following table:

	December, pounds		November, pounds	
Stocks on hand in the United States on first of month		47,929,429		32,566,382
Production		138,990,421		134,087,708
		186,919,850		166,654,090
Domestic deliveries	21,938,570		48,656,858	
Foreign deliveries	73,542,413		70,067,803	
		95,480,983		118,724,661
Stocks on hand at end of month		81,438,867		47,929,429

NEW YORK METAL MARKET PRICES

	Jan. 6 Bid	Jan. 6 Asked	Jan. 13 Bid	Jan. 13 Asked
Copper:				
Standard, spot*	.....	.....	.....	.....
	Selling prices		Selling prices	
	£ s. d.		£ s. d.	
London, standard, spot*	64 3 9		62 17 6	
Prime Lake	15.00	.....	14.50	.....
Electrolytic	14.25	to 14.62½	14.25	.....
Casting	14.25	to 14.50	14.00	to 14.12½
Copper wire base	15.75	.....	15.50	.....
Lead	4.15		4.10	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.50		7.50	
Spelter, spot	5.25	to 5.35	5.25	to 5.35
Tin, spot	36.77½	to 37.12½	36.85	to 37.00
Aluminum:				
Prompt delivery	18.50	to 19.00	18.75	to 19.00
Future	18.25	to 18.75	18.50	to 19.00

*OLD METALS

Heavy copper and wire	13.50	13.50
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	4.05	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Jan. 13 14,175

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Eastern Power & Light Reorganization.—The official staff of the Reading Transit & Light Company has undergone a change recently, following the decision of W. S. Barstow to resign as active head of the company. Mr. Barstow's place has been taken by N. McD. Crawford, formerly president of the Mahoning & Shenango Railway & Light Company, which is controlled by the Republic Railway & Light Company.

Pennsylvania Charters Granted.—Articles of incorporation were filed recently by eleven electrical companies which propose to supply energy to a number of towns in the eastern part of Bucks County, Pa. The incorporators were S. D. Warriner, H. F. Baker and R. H. Wilbur, all officials of the Lehigh Coal & Navigation Company, which controls, through the Lehigh Navigation Electric Company, a large steam generating station at Hauto, Pa., now nearing completion.

Southwestern Utility Merger.—The Seven Cities Company has been organized with an authorized capital stock of $250,000 and $250,000 bonds as a consolidation of the Russellville (Ark.) Water & Light Company and the smaller concerns operating in the towns of Dardanelle, Bentonville, Rogers, Morrilton, Springdale and Fayetteville, Ark. The Russellville company has a combined hydroelectric and steam plant and will furnish the main source of power for the merger at the present time.

Mexican Northern Power Company Passes Bond Interest.—In a circular issued recently to its stock and bondholders the Mexican Northern Power Company cited some of the conditions which led to the deferring of payment of the interest, due Jan. 1, on its outstanding $10,000,000 of first mortgage thirty-year 5 per cent bonds. The unsettled state of affairs in Mexico has prevented active work on the dam and power plant of the company on the Conchas River, Chihuahua, but a little progress has been made and no damage has been done to the properties by the military operations in the vicinity.

Canadian Utility Plans Additional Generating Units.—An announcement recently made by the Western Canada Power Company, Ltd., tells of the plans of that concern regarding additions to its generating equipment at the Stave Falls plant during the coming year. It is proposed to double the capacity of the present station by the addition of two units of 12,500-hp rating. One of these units is to be installed early in the year and the other toward the end of the year. The dam at Stave Falls was raised 10 ft. during 1913, and it is proposed to add another 10 ft. this year and the final 10 ft. in 1915.

Sterling-Meaker Company Matters.—Early in December the Sterling-Meaker Company, of Newark, N. J., maker of electric railway supplies and apparatus, executed a license agreement giving to the Lord Manufacturing Company, of Bush Terminal, Brooklyn, N. Y., the exclusive right to manufacture and sell the Sterling-Meaker products. The agreement was approved by the holders of the company's bonds, who authorized the sale of the plant and material. A. H. Favour and C. H. Baum have been appointed a committee to represent the bondholders and to take charge of the company's finances, with special reference to the discharging of its obligations.

Wisconsin Utilities Issue Bonds.—Approval has been obtained from the Wisconsin Railroad Commission for the issue by the Milwaukee Electric Railway & Light Company of $3,500,000 of refunding and extension mortgage bonds, to bear interest at the rate of 4½ per cent per annum, and to be pledged and deposited with the Bankers' Trust Company, as security for a like amount of bonds previously issued, bearing a higher interest rate. The Green Bay Gas & Electric Company has been authorized to issue $78,000 in first mortgage bonds to be used in discharging an existing indebtedness of $70,200, and permission has been granted to the Wisconsin Public Service Company to issue the same par value of 5 per cent bonds. These are to be used to purchase the issue of the Green Bay company, the remaining property of which will shortly be taken over by the Wisconsin Public Service Company.

Canadian Company Increases Dividend Rate.—A quarterly dividend of 1½ per cent has been declared on the $2,000,000 outstanding stock of the Kaministiquia Power Company of Montreal, Canada, payable next month. This rate compares with those of 3 per cent per annum paid from May, 1910, to November, 1911, and with quarterly rates of 1 per cent from February, 1912, to November, 1912, and 1¼ per cent from May, 1913, to November, 1913. The issue of $200,000 new stock at par has been authorized by the stockholders.

Alabama Traction, Light & Power Rushing Coosa River Plant.—During the past week word has been received of the completion of the dam at Lock 12 on the Coosa River and electric operation will follow shortly. This is the first of a number of hydroelectric generating stations which the Alabama Traction, Light & Power Company proposes to build along the Coosa, Tallapoosa and Tennessee Rivers in Alabama, and which will eventually be connected in one large system supplying light and power to the district around Birmingham and Montgomery.

Receivership for the Idaho Railway Light & Power Company.—Upon the application of the Westinghouse Electric & Manufacturing Company, which is creditor to the amount of $40,000, the property of the Idaho Railway Light & Power Company was placed in the hands of a receiver by Judge Dietrich in the United States District Court, at Boise, Idaho, on Dec. 23. O. G. F. Markhus, former general manager, has charge of the property, and a plan for general reorganization of the company is being considered. The receiver is in direct charge of the company's generating properties, including the Swan Falls power plant and transmission lines and the distributing stations at Nampa, Caldwell, Middleton, Star and Eagle, Idaho. The traction properties of the company are not directly affected by the receivership at the present time, and they will be operated by the Idaho Traction Company as lessees. These properties include the street railway lines in Boise and the interurban line conecting Boise, Nampa, Caldwell and Middleton.

Barcelona Traction, Light & Power Company Matters.—The Barcelona Traction, Light & Power Company is completing the construction work on the Seros concession on the Ebro River near Barcelona, Spain, started December, 1912. The generating equipment to be installed in the power house at this location consists of four units of about 15,000 hp, one of which is expected to be in operation by the end of January, and the other three by the end of April of the present year. Provision has been made for the future installation of another unit of the same size when the demand requires it. For the purpose of carrying out its program in Spain, a company was formed under the name of the Ebro Irrigation & Power Company, Ltd., with a capital stock of $2,500,000 owned entirely by the Barcelona company, which is in turn controlled by the Pearson interests. The above development is one of a number which are in progress or contemplated in various sections of Spain, and a network of transmision lines is planned which will distribute electricity to a large territory around Barcelona.

Pennsylvania Corporations Increase Capital Stocks.—Many millions of dollars were added to the capital stock and indebtedness of various Pennsylvania corporations during the closing weeks of the old year. In December forty-eight corporations filed notices at the State Department of their purpose to increase their capital stock or their debt and in some instances both. The electrical interests represented in this final movement under the old law were the Shohola Falls Hydroelectric Company, Milford, stock, $6,000 to $500,000; Westinghouse Gear & Dynamotor Company, Pittsburgh, stock, $5,000 to $1,500,000; Beacon Light Company, Philadelphia, stock, $120,000 to $500,000; Edison Electric Illuminating Company, Mount Carmel, stock, $150,000 to $200,000; Wellsboro Electric Company, Wellsboro, stock, $20,000 to $40,000; Trumbauersville Electric Light & Power Company, Norristown, stock, $5,000 to $12,500; Richland Electric Light & Power Company, stock, $5,000 to $10,000; Paupack Electric Company, Hawley, stock, $20,000 to $65,000; Harrisburg Light & Power Company, Harrisburg, debt, $1,750,000; Perry County Telephone & Telegraph Company, Landisburg, debt, $5,500; St. Mary's Electric Light Company, stock, $50,000 to $75,000, debt, $25,000 to $75,000.

Business Notes

Edwards & Company, electrical manufacturers, of New York, have opened a branch office in Chicago, at 629 West Jackson Boulevard, in charge of G. C. Richards.

The National Electric Sign & Construction Company, of 130 North Main Street, Mansfield, Ohio, has just installed machinery equipment and stock in its new factory.

Verne W. Shear & Company, Flatiron Building, Akron, Ohio, have been appointed Ohio representatives of the Condit Electrical Manufacturing Company, of Boston, Mass.

The Nachod Signal Company, Inc., is the new name of the concern formerly located at 214 South Twelfth Street, Philadelphia, and known as the Nachod Signal Company. The new address of the company is 50 Church Street, New York.

The Westinghouse Lamp Company will remove its administrative, executive sales, treasury, auditing and purchasing departments from Bloomfield, N. J., to the Martin Building, 1261 Broadway, New York. The new quarters will be occupied on Jan. 19, 1914.

The Pittsburgh High-Voltage Insulator Company, of Derry, Pa., has established a Chicago office at 320 New York Life Building and has appointed as its Canadian representative the Canadian General Electric Company, King and Simcoe Streets, Toronto, Ont.

The Utilities Engineering Corporation, with headquarters in the Michigan Trust Building, Grand Rapids, Mich., is now prepared to undertake the construction, operation or management of public utility properties. A. I. Snyder is president and manager of the company.

The Electric Contracting Company, of Trenton, N. J., has completed arrangements for carrying on its electrical contracting repair and supply business with offices at 23-25 Chancery Street in that city. Walter Eldridge is president and treasurer of the company and F. J. Carr is its secretary.

The Electrical Testing Laboratories, Inc., of New York, have recently made a number of changes in their official and executive staff. At present the officers are as follows: J. W. Lieb, Jr., president; Dr. C. H. Sharp, vice-president and technical director; P. S. Millar, secretary and general manager, and F. M. Farmer, chief engineer.

The National Supply & Equipment Company, Inc., has opened an office in the Bulletin Building, Philadelphia, Pa., as consulting engineer and dealer in steam, electrical and hydraulic equipment. The officers of the company are: H. W. Bishop, president; T. T. Taylor, vice-president; F. T. Finch, secretary; C. B. Dungan, treasurer, and B. J. Morrison, general manager.

The C & C Electric & Manufacturing Company, of Garwood, N. J., has discontinued its Pittsburgh office, and the territory formerly handled from that center will be taken care of by J. C. Chamberlin from the Philadelphia office. F. A. Saylor, with offices in the Greenwood Building, Sixth and Vine Streets, Cincinnati, Ohio, has been appointed agent of the company for the southern part of Ohio.

The Chicago Electric Motor Car Company has been taken over by the Carl Electric Vehicle Company, 641 Ohio Building, Toledo, Ohio. Note was made in the Dec. 13 issue of the *Electrical World* concerning the decision of the former company to enter upon the manufacture of electric commercial vehicles, but at that time nothing was known of the proposed merging of the two companies. No details are available as to the probable organization changes following this consolidation.

The Cutter Electrical & Manufacturing Company, of Philadelphia, Pa., which manufactures I-T-E circuit-breakers, has opened a new office in the Telephone Building, Indianapolis, in charge of Lynn O. Morrow, whose territory will include southern Indiana, southern Illinois, Kentucky, Tennessee and Missouri. The new Indianapolis office will be under the general supervision of Henry F. Darby, Jr., Chicago district manager. Mr. Morrow has been connected with the Cutter company for over six years, having spent about four years in the engineering department.

Hermann Boker & Company, of 101 Duane Street, New York, announce the transfer of W. H. Kissam from their New York office to the managership of their Cleveland branch office. H. G. Harrington, formerly assistant sales manager of the Driver-Harris Wire Company, has been appointed manager of the wire and nickel department at the New York office.

The Swedish General Electric, Ltd., with headquarters at 1009-1012 Kent Building, Toronto, Ont., and branch offices at Montreal, Calgary and Vancouver, has taken over the business of Kilmer, Pullen & Burnham, Ltd. The change is rather of name than of organization, as Frank Pullen is president of the new company and the same lines will be handled as formerly.

The Hammer-Beach Electric Company has opened offices at 97 Seneca Street, Geneva, N. Y., to handle an electrical contracting and supply business. The president of the company, A. R. Page, was formerly with the Wheeler-Green Electric Company, as was E. T. Beach, vice-president. H. O. Palmer, secretary of the concern, is also vice-president of the Empire Gas & Electric Company, of Geneva.

The Atlas Electric Sign Company, of 742 South Wabash Avenue, Chicago, Ill., which has been established about two months, has already placed a number of large electric signs and has a good outlook for business in the future. A. W. Losee, president of the company, as well as V. C. Thompson, its secretary, and Charles Husum, construction superintendent, were formerly with the Chase Electric Company.

The General Storage Battery Company has located its office and plant at 2005 Locust Street, St. Louis, Mo., and will be ready about Feb. 1 to handle orders for automobile ignition, lighting and starting batteries, and for laboratory and other special batteries. Joseph Desloge is president of the company. Its vice-president, Louis Desloge, was formerly connected with the Union Electric Light & Power Company, and E. A. Downey, its secretary, was with the Wagner Electric Manufacturing Company previously.

New Industrial Companies

The Manhattan Brass & Electrical Company, of New York, N. Y., has been incorporated with a capital stock of $14,000 by Harry Hilfman, Samuel and Henry Denemark, 147 McKibbin Street, Brooklyn, N. Y.

The Guth Electrical Company, of Perth Amboy, N. J., has been incorporated with a capital stock of $50,000 by M. J. Dahl, A. Guth and D. Guth, of Perth Amboy. The company proposes to do a general electrical and mechanical engineering business.

The Atlantic City Electric Company, of New Jersey, has been chartered with a capital stock of $250,000 to do a general electrical and mechanical engineering business. The incorporators are T. D. Finizio, of Cliffwood; L. Biondi and B. A. Turcott, of New York, N. Y.

The Toll & Leeds Company, of Newark, N. J., has been incorporated by W. S. Leeds, of Clifton, N. Y.; S. E. Toll, of New York, N. Y., and W. A. Seeley, of Newark. The company is capitalized at $500,000 and proposes to manufacture motors, electrical machinery, etc.

The A. & T. Storage Battery Company, of New York, N. Y., has been chartered with a capital stock of $1,000,000 by J. Splitdorf, D. B. Nally and A. L. Kull, of New York, N. Y. The company proposes to manufacture and deal in storage batteries, generators for light, heat, power, etc.

The Machinery Equipment Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $10,000 to carry on a general mechanical and electrical engineering business. The incorporators are F. R. Hansell, of Philadelphia, Pa.; G. H. B. Martin and S. C. Seymour, of Camden, N. J.

The Fowler Standard Lamp Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $400,000 for the purpose of manufacturing and selling electrical machinery. The incorporators are J. M. Satterfield, of Dover, Del.; C. R. Duscher, of Jenkintown, Pa., and W. C. Arnold, of Lansdowne, Pa.

Trade Publications

Cord.—The supply department of the General Electric Company has issued price list and data of cords and portables of National Electric Code standard.

Lighting Fixtures.—The F. W. Wakefield Brsas Company, Vermilion, Ohio, is issuing an invitation to dealers to send for its new electric-lighting fixture book, No. 14.

Mica.—The Producers' Mica Company, of Chicago, issued a novel New Year's greeting, in which its message was printed in letters of gold on a card of transparent mica.

Test Clip.—A leaflet recently issued by R. S. Mueller & Company, 423 High Avenue, Cleveland, Ohio, refers to the "Big Brute" test clip, which will carry 100 amp indefinitely without heating.

Induction Motors.—An eight-page leaflet, No. 4005, has been issued by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., which contains illustrations and a description of its polyphase motors.

Refillable Fuses.—A sixteen-page booklet has been issued by the Multi Refillable Fuse Company, 817 Washington Boulevard, Chicago, Ill., covering its complete line of refillable fuses and stamped links.

Calendar.—The Nungesser Carbon & Battery Company, 3803 King Avenue, Cleveland, Ohio, has issued an attractive little calendar, on which is illustrated the "1900" dry battery and the "Acme" rapid-fire battery.

Portable Buffer.—The Stow Manufacturing Company, Binghamton, N. Y., is mailing an illustrated leaflet referring to its portable electric buffing machine for use on automobiles and for brass signs on metal work.

Heating Pad.—The Hotpoint Electric Heating Company, Ontario, Cal., is distributing a leaflet referring to its latest improved heating pad, called the "El Comfo." Being concave on one side and consequently convex on the other, it is easily adjusted to any part of the body.

Ammonia Compressors.—The Huetteman & Cramer Company, Detroit, Mich., manufacturer of ice and refrigerating machinery, is sending out a folder referring generally to its experience in the design of ice machinery and specifically to its safety ammonia compressors.

Telefault.—"Matthews Telefault" is the subject of a leaflet recently issued by W. N. Matthews & Brother, St. Louis, Mo. This instrument is used to locate all cable conductor troubles except "opens." It will discover dead short-circuits or faults with a very high resistance.

Window Advertising.—A folder has recently been issued by the Electro Novelty Company, 160 North Fifth Avenue, Chicago, Ill., entitled "Does Your Store Window Pay?" In it are illustrated various "mysteries," electrically operated, for attracting the attention of the passer-by to the merchant's window.

Indirect Lighting.—The National X-Ray Reflector Company, Chicago, Ill., has begun the publication of "Eye Comfort." This will be issued monthly to disseminate information on the latest discoveries in scientific illumination. Vol. I, No. 1, contains simplified data for laying out "Eye Comfort" installations and other material of interest.

Electric Motors for Printing Presses.—The Jenney electrical department of the American Rotary Valve Company, of Chicago, is sending out a reproduction of a page advertisement in the Indianapolis *News* showing that every wheel that revolves in the operation of that paper, from typesetting to delivery, is turned by a Jenney electric motor.

Wire Rope.—John A. Roebling's Sons Company, 117 Liberty Street, New York, has issued in bulletin form advance sheets of an article on "The Wire Rope at Panama" that will appear in "The History of the Panama Canal: Its Construction and Builders." Some excellent illustrations are given showing various application of the wire rope, and a brief history of wire-rope making from the time of its earliest use in this country makes interesting reading. An illustration is shown of a wire rope 3.25 in. in diameter, which has six strands of thirty-seven wires each twisted around an independent wire rope of six strands of nineteen wires each, which in turn are twisted around a blue hemp center.

Personal Mention

Mr. Asa Williams has been appointed superintendent of the municipal electric light and water plants of Fresno, Cal.

Mr. C. C. Adams has succeeded Mr. J. S. Johnston as superintendent of the Cynthiana (Ky.) Electric Light Company.

Mr. A. E. Potter has been appointed superintendent of the Baraboo (Wis.) Gas & Electric Company, vice Mr. G. I. McFarland, resigned.

Mr. James De Young, manager of the Consumers' Power Company's branch in Owosso, Mich., tendered his resignation, effective Feb. 1.

Mr. J. C. Rushin, of Atlanta, Ga., has been appointed manager of the new-business division of the Havana (Cuba) Electric Railway, Light & Power Company.

Mr. W. Cobb, of Kalamazoo, Mich., has been appointed manager of the Consumers' Power Company's branch in Owosso, Mich., vice Mr. James De Young, resigned.

Mr. G. I. McFarland has resigned as superintendent of the Baraboo (Wis.) Gas & Electric Company and removed to Salt Lake City, where he will engage in other business.

Mr. E. A. McCoy, who has been manager of the commercial division of the Columbia (S. C.) Railway, Gas & Electric Company since 1911, has resigned from its service.

Mr. Harry H. Wells, district manager for the Public Service Electric Company of the Orange district, has been appointed divisional agent of Essex County for the company.

Mr. O. H. P. Fant, vice-president of the St. John's Light & Power Company, of St. Augustine, Fla., has been appointed superintendent of the system in charge of operation.

Mr. E. L. Wells has resigned as manager of the Marshall (Tex.) Electric Company, the Marshall Ice Company and the Marshall Traction Company and has been succeeded by Mr. G. H. Caffery.

Mr. B. C. Candee has resigned as superintendent of the municipal electric-light plant of Dunkirk, N. Y., and accepted the position of secretary of the Buffalo (N. Y.) Metal Goods Company.

Mr. F. E. Schornstein, former manager of the Salina (Kan.) Light, Power & Gas Company, has been appointed general manager of the Eakin-Donelan Company, with headquarters at Concordia, Kan.

Mr. Richard R. Young, formerly division agent of the Public Service Gas Company and the Public Service Electric Company, Newark, N. J., has been made new-business agent for the State of New Jersey for these two companies.

Mr. E. A. Bell has resigned as electrical engineer of the Elgin lighting department of the Aurora, Elgin & Chicago Railway Company to devote his time to the motor and repair company which he recently founded at Elgin, Ill.

Mr. George H. Caffery has been appointed manager of the Marshall (Tex.) Electric Company, the Marshall Ice Company and the Marshall Traction Company. Mr. Caffery was formerly manager of the United Electric Light & Water Company, of Norwalk, Conn.

Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, Chicago, has been awarded the Octave Chanute medal by the Western Society of Engineers, as the author of one of the best three papers presented before that society during the year 1913.

Mr. N. I. Garrison has been appointed assistant manager of the Fort Smith (Ark.) Light & Traction Company. Mr. Garrison, who was previously associated with this company, has been for the past year connected with the Western States Gas & Electric Company, at Stockton, Cal.

Mr. Palmer Yorke, former treasurer of the Fitchburg (Mass.) Gas & Electric Light Company and recently in charge of the publicity work of the Tenney Company, has been made assistant to the president of Charles H. Tenney & Company, public utility manager of Boston, Mass.

Mr. F. J. Derge, manager of the light, heat and power departments of the Toledo (Ohio) Railways & Light Company, was operated on for appendicitis at St. Vincent's Hospital on Jan. 4. The operation is said to have been successful, and Mr. Derge is now on the road to recovery.

Mr. C. A. Hoppin, general superintendent of the electric department of the Central Illinois Light Company of Peoria, Ill., has resigned to engage in consulting engineering practice. Mr. Hoppin, who is a graduate of the Illinois State University, has been connected with the Central Illinois Light Company for more than six years.

Mr. George F. Maddock has been appointed manager of the examinations and reports department of H. M. Byllesby & Company, Chicago, succeeding Mr. Harold Almert, resigned. Mr. Maddock has been the engineering representative of Byllesby & Company on the Pacific Coast for a number of years, residing in Berkeley, Cal. The appointment was effective Jan. 1.

Mr. C. W. Clark has resigned as superintendent, electrical engineer and purchasing agent of the Marion, Bluffton & Eastern Traction Company and the Bluffton, Geneva & Celina Traction Company, Bluffton, Ind., with which he has been connected since July 15, 1906. Mr. Clark will take charge of the Bluffton Electric Light & Water Works as general manager. He has been connected with interurban railway and electric light work since February, 1901.

Mr. W. W. Cole, consulting engineer for Day & Zimmerman, of Philadelphia and New York, was tendered a banquet at the Venango Club, Oil City, Pa., on Jan. 3. Since last March Mr. Cole has been managing the affairs of the Citizens' Traction Company, superintending its improvements and extensive work of the parent company, the Venango Light & Power Company. The banquet was planned by prominent business and professional men in appreciation of what Mr. Cole did for the good of the city during his ten months' residence there.

Mr. W. C. Gordon has been appointed transportation engineer for the Canadian General Electric Company, Ltd. Mr. Gordon, who is a graduate of Cornell, has had wide experience in connection with city, interurban and trunk-line electric railways. In 1899 he entered the testing department of the General Electric Company at Schenectady, and while with the railway construction department he had charge of the installation of the Manhattan Elevated Railway system in New York, and later of the installation of the Northwestern Elevated Road in Chicago and other roads in that territory. He was also closely associated with the electrification of the New York Central and the Interborough Rapid Transit lines. He went to Australia for the General Electric Company and was manager and engineer of the North Melbourne Tramways & Lighting Company, Ltd., engineer for the National Electrical & Engineering Company, Ltd., which handled the New Zealand business for the General Electric Company, and until his return to Canada was engineer for the Brisbane Tramways Company, Ltd.

Obituary

George J. Weber, a well-known inventor and builder of gas engines, died at his home in Kansas City on Jan. 7. He was formerly president of the Weber Gas & Gasoline Engine Company. Mr. Weber was sixty-five years old.

Richard Nott Dyer, for many years chief patent attorney for Mr. Thomas A. Edison and a member of the law firm of Dyer, Dyer & Taylor, died at his home in Orange, N. J., Jan. 13. Mr. Dyer was born in Calais, Me., fifty-six years ago and was graduated from the Columbian University, Washington, D. C. He was admitted to the bar in Chicago in 1879, and two years later went to Menlo Park, N. J., as Mr. Edison's attorney. He fought the famous patent case of the incandescent lamp through all the courts to the United States Supreme Court, obtaining numerous decisions which ever since have been quoted in patent cases. He also prepared the patents on the phonograph and kinetoscope and carried these cases through the courts. Later he became counsel for the Sprague Electric Company and for several years had charge of the patent work of the General Electric Company.

Construction

New England

DAMARISCOTTA, MAINE.—The Portland Pwr. & Devel. Co., of Damariscotta, expects to purchase material for distribution system (regular purchases) and some electrical appliances and supplies. J. K. Waterhouse is general manager.

WATERVILLE, MAINE.—The Central Maine Pwr. Co., of Waterville, has purchased an extensive water-power privilege in Skowhegan from the Skowhegan El. Co., recently incorporated.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 31 for the construction of two 300-ft. towers and concrete foundations at the United States naval station, Boston, Mass. Separate proposals will be entertained for structural steel work and for concrete foundations. The cost of the work is estimated at $12,000. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station named. H. R. Stanford is chief of bureau.

WESTFIELD, MASS.—At a town meeting held Jan. 5 the voters rejected the proposal to purchase electricity from the Amherst Pwr. Co. to operate the municipal electric-light system and voted to issue $25,000 in bonds for the purchase of new equipment for the municipal plant. The plans provide for a 300-hp boiler and a 500-kw generator.

WESTERLY, R. I.—The Westerly Lt. & Pwr. Co. expects to erect a fireproof substation in Watch Hill within the next six months. M. H. Spellman is general manager.

Middle Atlantic

ELLENVILLE, N. Y.—Bids will be received by H. Westlake Coons, secretary of the Ellenville school board, until Feb. 2, for the construction and completion of a high school building, including heating, electrical work, plumbing, etc.; a separate bid is to be submitted for heating. Plans may be seen at the office of the school board, Ellenville, or at the office of S. O. Lacey, architect, 415 Phelps Building, Binghamton.

NEWARK VALLEY, N. Y.—At a special election held recently the proposal to issue $13,000 in bonds for the installation of an electric-light plant was carried. Steps will be taken at once to begin work on the system.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 13, for a non-interfering local fire-alarm system at the United States Appraisers' Warehouse, New York, N. Y. For details see proposals columns. O. Wenderoth is supervising architect.

NEW YORK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Feb. 2, for a fire-alarm system at Manhattan State Hospital, Ward's Island, N. Y. Drawings and specifications may be consulted and blank forms of proposal obtained at the Manhattan State Hospital, Ward's Island, N. Y., at the office of the State Hospital Commission, No. 1 Madison Avenue, New York, N. Y., and at the office of Lewis F. Pilcher, state architect, Capitol, Albany. J. H. B. Hanify is secretary of commission.

WATERTOWN, N. Y.—In his message to the Common Council, Mayor I. R. Breen recommends the installation of a municipal electric-lighting plant. The present cost of lighting the streets and public buildings is about $30,000 per year.

BENTON, PA.—Within the next six months the Benton El. Co. expects to purchase two small three-phase, 60-cycle, 2300-volt alternators (about 35-kw and 50-kw) and two 18-in. water turbines; also material for a single-phase transmission line, about 4 miles long, and a series tungsten street-lighting system, consisting of 40 100-watt lamps. Glen Appleman is superintendent.

LANCASTER, PA.—The capital stock of the Conestoga Trac. Co., of Lancaster, has been increased from $4,000,000 to $5,000,000, the proceeds to be used for improvements to the entire system. W. W. Griest, of Lancaster, is president.

McCALL FERRY, PA.—The Pennsylvania Wtr. & Pwr. Co., of McCall Ferry, is contemplating increasing the output of its plant by 17,000 hp and will install an additional water turbine and generator. James L. Rintoul, assistant treasurer, United States Fidelity & Guaranty Building, Baltimore, Md., is in charge of purchasing department. John. A. Walls is chief engineer.

PHILADELPHIA, PA.—Bids will be received by A. F. Hammond, superintendent of supplies, Room 392, City Hall, Philadelphia, until Jan. 1, for lighting fixtures (gas and combination) for the new Horace Furness School building at Third and Mifflin Streets. All necessary information, specifications, etc., may be obtained upon application to the office of the superintendent.

READING, PA.—The Reading Merchants' Ice Co. is installing a new vertical ammonia compressor of 175 tons refrigerating capacity, made by the York Mfg. Co., of York, to be driven by a 300-hp General Electric motor with eight small Westinghouse motors to drive the necessary auxiliaries. All switches and switchboards will be furnished by the General El. Co. The Metropolitan El. Co., of Reading, will furnish electricity from a direct-current 2300-volt, three-phase, 60-cycle trunk line to operate the ice plant. William E. Zieber is secretary of the ice company.

STATE COLLEGE, PA.—Bids will be received nntil Jan. 28 for the construction of a liberal arts building at State College, Pa., including heating, plumbing and electrical work. Plans and specifications may be seen at the offices of President Edwin E. Sparks, State College; McKee, Mitchell & Alter, Park Building, Pittsburgh; State superintendent of grounds and buildings, Capitol, Harrisburg, and Day & Klauder, architects, 925 Chestnut Street, Philadelphia. For further particulars apply to the architects.

WILKES-BARRE, PA.—Bids will be received at the office of the city clerk, Wilkes-Barre, until Jan. 27, for furnishing all labor and material for installing one 14-circuit switchboard and one 20-circuit protector board, together with batteries and battery racks for fire-alarm system. For further information address Fred H. Gates, city clerk. Joseph G. Schuler is superintendent of Department of Fire and Public property.

TRENTON, N. J.—A report submitted recently to the city commission by John H. Gregory, of the firm of Hering & Gregory, 170 Broadway, New York, N. Y., consulting engineers, engaged to consider the question of constructing a garbage disposal plant, recommends the installation of a garbage incinerator and power plant, at a cost of $195,000, which will generate power to operate the pumps planned for the sewage-disposal plant to raise sewage from the outfall sewer to the septic sewer.

WHIPPANY, N. J.—The Hanover Brick Co., of Whippany, is contemplating equipping its works with electrically operated machinery. The company has contracted with the Morris & Somerset El. Co., of Morristown, for electricity to operate its plant, which will erect a new transmission line to the works from its Whippany-Boonton line at Monroe.

BALTIMORE, MD.—Plans have been prepared by Robert J. McCuen, superintendent of lamps and lighting, for the proposed extension of an ornamental system of street-lighting in the business and residential section, including both arc and tungsten lamps. Arc lamps are to be installed in the business section, of which there are to be 400 (6.6-amp lamps) surmounted on ornamental standards especially designed by the municipal art commission and known as the "Baltimore post." When these additional lamps have been installed a total of 800 of this type of lamp will be in service in the business section of the city. Approximately 300 tungsten lamps of 60 cp, with alba globes, surmounted on ornamental standards of the same type as the arc standards, only smaller, will be installed, making a total of 1000 lamps of this type in the residential section. All of these lamps will be maintained by the underground service. The arc lamps will be installed by the Consol. Gas, El. Lt. & Pwr. Co., of Baltimore, and the tungsten lamps will be installed by the working force of the Department of Lamps and Lighting.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 14 for furnishing and installing on foundations provided by the government in the central power plants, United States navy yards, at Mare Island, Cal., and Puget Sound, Wash., two motor-driven fire pumps of 1000 gal. per minute capacity, 400-ft. head, and two steam turbine-driven heating system pumps of 1000 gal. per minute capacity, 150 lb. per square in. gage, to cost approximately $14,000. Plans and specifications may be obtained upon application to the above bureau or to the commandants of the navy yards named. H. R. Stanford is chief of bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 3 for furnishing at the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 6255—one steam-driven air compressor; Schedule 6273—1100 ft. soft-steel controller, armored cable for searchlights, 500 ft. soft-steel, lead and armored interior communication cable, 1000 ft. soft-steel, leaded and armored single-conductor wire; Schedule 6272—15,000 ft. stranded, portable ship-lighting cable, 10,000 ft. twisted telephone wire. Bids will also be received at the same place until Feb. 10 for miscellaneous voltmeters, ammeters and wattmeters at Mare Island, Cal., as per Schedule 6258. Applications for proposals should designate the schedule desired by number. T. J. Cowle is paymaster general, U. S. N.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 27, for furnishing at the various navy yards and naval stations the following supplies: Norfolk, Va., Schedule 6240—two ventilating blowers. Brooklyn, N. Y., Schedule 6236—40-pair lead-sheathed telephone cable. Philadelphia, Pa., Schedule 6242—six watchmen's clocks, miscellaneous sleeves and sockets for Morse taper shank twist drills. Bids will be received at the same place until Feb. 3 as follows: Puget Sound, Wash., Schedule 6231—fuel-oil burning apparatus. Mare Island, Cal.; Schedule 6230—two sets storage batteries for use in electric trucks; Schedule 6234—25,000 yd. condenser tube packing. East and West, Schedule 6228—8200 dry cells. Bids will also be received until Feb. 17 for furnishing at the Brooklyn navy yard three 5-kw radio sets for shore installation as per schedule 6246. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

North Central

BOYNE CITY, MICH.—The Boyne River Pwr. Co. expects to purchase within the next 12 months a complete outfit for 4-amp luminous arc-lamp lighting system, adding 17 arc lamps to its present system, consisting of 33 arc lamps.

COLDWATER, MICH.—The managers of the municipal electric-light plant expect to purchase within the next three months two (300-hp each) water-tube boilers. William H. Friedrich is superintendent.

DETROIT, MICH.—The State Railroad Commission has granted the Detroit Edison Co. permission to increase its capital stock from $15,000 to $25,000,000 and to issue $3,400,000 in bonds. Improvements and extensions involving an expenditure of $3,000,000, it is understood, will be made in Detroit during 1914. Alexander Dow is president and general manager.

EAST JORDAN, MICH.—Within the next 12 months the East Jordan El. Lt. & Pwr. Co. expects to purchase 50 or 75 lamp-posts for lighting Main Street. The company has recently installed one 12-in. by 24-in. by 30-in. tandem Corliss engine, directly connected to 250-kw generator; two 72-in. by 18-ft. boilers, pumps, condensers, exciters, switchboards, etc. L. G. Balch is superintendent.

GLADWIN, MICH.—Within the next 30 days the Gladwin Lt. & Pwr. Co. expects to purchase one 100-kva, three-phase, 60-cycle, 2300-volt generator (belted), one water-wheel, one generator panel, transformers, etc. S. B. Wiggins, 709 Kirby Building, Saginaw, Mich., is consulting engineer.

HOLLY, MICH.—The Independent Pwr. Co. is contemplating extending its transmission lines south and east of Holly to Davisburg. The company will furnish electricity to the farmhouses along the line. George C. Weber is manager.

KITZVILLE, MICH.—The Village Council has granted the Chisholm El. Co., of Chisholm a franchise to furnish electricity for lamps and motors here. The Council has also entered into a contract with the company for lighting the streets of the city.

LANSING, MICH.—The city of Lansing will need about one-half mile of underground conduit for the municipal electric-light system; also material for distribution system; nothing definite decided upon at this time. C. D. Dodge is superintendent.

LOWELL, MICH.—The town of Lowell is contemplating the installation of a rectifier and more street lamps. Nothing definite has yet been decided upon. Frank J. McMahon is superintendent.

MARCELLUS, MICH.—The board of commissioners is contemplating the installation of an additional engine and generator to furnish electricity for lamps and motors (day service). As yet nothing defi-

nite has been decided upon. Frank L. Knight is superintendent of water and light department.

MENOMINEE, MICH.—The Menominee & Marinette Lt. & Trac. Co. expects to install within the next two months a 200-kw motor-generator set for street-railway service. Edward Daniell is general manager.

MILLINGTON, MICH.—Oliver B. Whipple, owner of the local electric-light plant, expects to purchase within the next six months one 50-kw, three-phase, 60-cycle generator, or a 50-kw, 250/125-volt, three-wire, direct-current generator, one 25-kw, 125-volt compound-wound generator, also one 2½-kw generator and material for street-lighting system for town of about 800. Mr. Whipple is also planning to erect 4 or 5 miles of transmission lines.

MORENCI, MICH.—Within the next four months the Morenci-Fayette Lt. & Pwr. Co. expects to purchase one compound condensing engine with a rating of from 200 hp to 250 hp and two step-down transformers with a rating of about 80 kva. George F. Avis is secretary and treasurer.

PERRINTON, MICH.—A complete electric-lighting system is being installed here. Already 25 100-watt lamps have been erected on the streets, and it is expected to install about 300 lamps in the stores and residences. Electricity for operating the system is furnished from the plant of the Lucas & Schultz Milling Co.

PICKFORD, MICH.—It is proposed to install a small electric-light plant in Pickford to furnish electricity for lighting the telephone exchange and other places of business. If satisfactory, a larger plant will be installed later on.

ST. JOSEPH, MICH.—The local electric-light company has submitted a proposal to the City Council offering to furnish and maintain 25 street lamps at $45 each per year, provided that the city erect the poles and install the wiring. To increase the output of the municipal electric-light plant to provide for the increased service would cost about $15,000.

WOLVERINE, MICH.—Within the next 12 months Preston & Sowton, owners of the local electric-light plant, expect to purchase a few small transformers, arresters, insulators and possibly 50 poles (25-ft. and 30-ft.), also a small supply of electrical appliances and supplies. O. B. Preston is manager.

BELLEFONTAINE, OHIO.—The City Council has authorized an issue of $36,000 in bonds, the proceeds to be used for increasing the output of the municipal electric-light plant.

BOLIVAR, OHIO.—The Bolivar Lt. & Pwr. Co. has applied to the Public Utilities Commission for permission to issue capital stock to the amount of $10,000. Of this stock $3,000 is to be delivered to N. L. Nash, in payment for the electrical distributing system in the village of Bolivar, the proceeds of the remaining $7,000 to be used for improvements and extensions to the property.

HURON, OHIO.—The Board of Trustees has engaged the United Engineering & Construction Co., of Cleveland, to take charge of remodeling the municipal electric-light plant, the installation of new generating equipment and a new street-lighting system. E. E. McCormick, president of the board of trustees, it is said, is ready to receive bids on electrical equipment.

NEW CONCORD, OHIO.—The Public Utilities Commission has granted the New Concord Wtr. & El. Co. permission to issue $17,000 in bonds, of which the proceeds of $7,255 will be used to pay for construction of plant, etc., and the remainder for future extensions and improvements.

BARBOURVILLE, KY.—The Barbourville El. Lt. & Pwr. Co. has purchased the franchise offered by the city. Plans are being considered by the company for extensive improvements and extensions to its system.

BOWLING GREEN, KY.—Plans are being considered for increasing the output of the municipal electric-light plant to provide electricity for maintaining an ornamental street-lighting system, which is being promoted by the business men and others.

COLUMBIA, KY.—The Columbia Ltg. Co. expects to purchase within the next six months one 37½-kva, single-phase, 60-cycle, 1100-volt or 1150-volt generator. A. H. Ballard is secretary and treasurer.

JACKSON, KY.—The Day Lumber & Coal Co., of Jackson, has purchased the property of the Swann-Day El. Co. Within the next two months the company expects to install meters in some portions of the town which now have flat-rate service; also to purchase some incandescent street lamps with gooseneck posts for street-lighting. George D. Lawrence is manager of the light plant and ice factory.

LEITCHFIELD, KY.—Within the next 30 days the Leitchfield El. Lt., Ht. & Pwr. Co. expects to purchase one 50-kw, three-wire, 250-volt directly connected generating unit, one 100-hp boiler, 125-lb. pressure (internally fired preferred), heater, pumps, etc. W. N. Moss is superintendent.

LONDON, KY.—The London El. Lt. & Pwr. Co. expects to purchase within the next 30 days one 14-in. double leather belt about 130 ft. long. W. F. Raymer is president and general manager.

MADISONVILLE, KY.—The Madisonville & Nortonville Lt., Pwr. & Trac. Co., recently incorporated under the laws of the State of Delaware, has asked the City Council for a franchise to furnish electricity for power purposes in Madisonville; the company also has offered to purchase the municipal electric-light plant. The construction of an interurban electric railway between Madisonville and Nortonville, a distance of 12 miles, is also contemplated by the company.

WINCHESTER, KY.—The city of Winchester, it is reported, is contemplating the establishment of an electric-light plant to maintain the ornamental street-lighting system recently installed.

CORYDON, IND.—Within the next 12 months the Corydon Lt., Wtr. & Ice Co. expects to erect about 1 mile of new line and to purchase one boiler, coal and ash handling system, poles, incandescent lamps, electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. Frank R. Wright is proprietor.

GOSHEN, IND. — Arrangements have been made by the city of Goshen for a temporary loan of $35,000 to provide funds for reconstructing the municipal electric-light plant.

PLYMOUTH, IND.—The Plymouth El. Lt. & Pwr. Co. has erected poles to Walkerton, a distance of 14 miles, for a 13,500-volt transmission line. As soon as this line is completed the company will build a line to Culver, 12 miles distant. The company is also contemplating extending its service to several small towns. Material for above extensions has been purchased. C. D. Snoeberger is owner and manager.

ATLANTA, ILL.—The capital stock of the Atlanta El. Lt. & Pwr. Co. has been increased from $10,000 to $30,000.

BYRON, ILL.—G. W. Petit, Jr., of Byron, has submitted a proposal to the City Council asking for a franchise to furnish electricity for lamps and motors; also a contract for street-lighting.

CAIRO, ILL.—The capital stock of the Cairo Ry. & Lt. System has been increased from $150,000 to $300,000.

EFFINGHAM, ILL.—The Effingham El. Lt. & Pwr. Co. has increased its capital stock from $15,000 to $105,000.

LITCHFIELD, ILL.—The United Gas & El. Co., of Litchfield, has increased its capital stock from $100,000 to $250,000.

MATHERVILLE, ILL.—The capital stock of the Matherville Lt. & Pwr. Co. has been increased from $10,000 to $40,000.

MOMENCE, ILL.—The capital stock of the Momence Utilities Co. has been increased from $25,000 to $75,000.

OAK FOREST, ILL.—The contract for the electrical work on the new county buildings under construction here has been awarded by the Board of County Supervisors to W. F. Cummings, 3407 West Monroe Street, Chicago, at $69,975.

PAXTON, ILL.—The Central Illinois Utilities Co., of Paxton, has obtained franchises in Melvin, Thawville, Danford, Ashkum, Chifton, Chebanse and Rankin. The company expects to extend its transmission lines to these towns this spring. L. N. Boisen is chief operating engineer, and C. H. Lindsay, of Watseka, is district superintendent.

SIDNEY, ILL.—The Homer El. Lt. & Pwr. Co., of Homer, recently granted a franchise in Sidney, will erect a high-tension line from Homer to Sidney, a distance of 6 miles. About 300 chestnut (30-ft.) poles and 12 miles of wire will be required for the proposed line. U. S. Thompson, of Homer, is proprietor and manager.

EAU CLAIRE, WIS.—The Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, informs us that it does not contemplate the construction of a new hydroelectric plant at Paint Creek the coming season, as reported in the issue of Jan. 3.

MANITOWOC, WIS.—The city of Manitowoc has taken over the electric plant of the Manitowoc El. Lt. Co. for a consideration of $145,000. It is planned to take over the gas plant and consolidate it with the electric and water-works plants.

ARGYLE, MINN. — The electric-light committee expects to purchase within the next six or eight months material for an ornamental street-lighting system. Martin Glende is superintendent.

AUSTIN, MINN.—Within the next 12 months the Board of Public Works expects to purchase a coal and ash-handling system, material for underground conduit, distribution cable, wire and posts. William Todd is superintendent.

BRAINERD, MINN.—The National Lt., Ht. & Pwr. Co., of Brainerd, has sold its property to the Cuyuna Range Pwr. Co., of Deerwood. The latter company has a hydraulic plant on the Crow Wing River, 10 miles from Brainerd, equipped with two generating units consisting of two 48-in. Morgan Smith horizontal water turbines and an Allis-Chalmers 600-kva, 2300-volt generator, and a transmission line, 35 miles long, erected on steel or concrete poles, transmitting electricity at 35,000 volts, serving towns and mines on the Cuyuna Range with electricity for lamps and motors. The company also has a 250-hp steam auxiliary plant and a 400-hp gas-producer plant. Construction work was completed Jan. 1, 1914. T. H. Croswell is vice-president.

DE GRAFF, MINN.—At an election held Dec. 23 the proposal to install a municipal electric-light plant was carried. The plant will be driven by a gas or kerosene engine. C. D. Noonan is city clerk.

FOLEY, MINN.—Within the next six months the Foley El. Lt. & Pwr. Co. expects to purchase one 30-hp and one 60-hp crude-oil or gas engine, two direct-current, 250-volt generators, one 20-kw and the other 40-kw. Herman E. Becker is general manager.

GRACEVILLE, MINN.—The Otter Tail Pwr. & Lt. Co., of Fergus Falls, has purchased the municipal electric-light plant and will operate the local system with electricity generated at its plant in Fergus Falls. The company has also erected a new auxiliary plant in Graceville. William McDonnell is village recorder.

HEIBERG, MINN.—Within the next few months J. F. Heiberg, owner of the local electric-light plant, expects to purchase one rectifier for charging auto batteries for lighting, etc.

MINNEAPOLIS, MINN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 30, for an electric passenger elevator, electric push-button lift, electric push-button dumb waiter, hydraulic freight and hydraulic ash lift in the United States post office at Minneapolis, Minn., in accordance with drawings and specifications, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

MINNEAPOLIS, MINN.—Adolph F. Meyer, consulting engineer of St. Paul, engaged to make an investigation as to establishing a power plant at the government canal to supply electricity to the cities of St. Paul and Minneapolis and the University of Minnesota, has submitted his report to City Engineer F. W. Cappelen and Dean F. C. Sheldon of the engineering department of the University of Minnesota, in which he recommends the installation of a power plant to cost about $700,000, which would provide for a development of 15,200 hp. The government has already spent $800,000 in the modification of the navigation to provide for the utilization of the water-power.

NEW PRAGUE, MINN.—Within the next three months the Electric Light and Water Works Department expects to purchase one 66-in. by 18-ft. high-pressure tubular boiler for 160 lb. working pressure; also to purchase within the next 12 months 20 5-amp and 10-amp, 250-volt direct-current meters and one carload of 25-ft. (7-in. top) cedar poles. Joseph T. Rynda is superintendent.

NEW ULM, MINN.—Bids will be received by A. F. Reim, clerk of the Independent School District of the city of New Ulm until Feb. 10 for all labor and materials for seven separate contracts as follows: (b) plumbing, (c) heating, (d) ventilating-fan equipment, (e) temperature regulation, (f) vacuum cleaning system, (g) electric installation, for the high school building to be erected in New Ulm, in accordance with plans and specifications prepared by Tyrie & Chapman, architects, 320 Auditorium Building, Minneapolis, which are on file at the offices of the clerk of Independent School District, New Ulm; of the architects, Minneapolis, and also at the Builders' Exchanges in Minneapolis and St. Paul.

PARKER'S PRAIRIE, MINN.—The installation of an electric-light system in Parker's Prairie is reported to be under consideration.

ST. PETER, MINN.—Within the next three months the City Council expects to purchase 32 ornamental lamp standards for five-lamp clusters. F. N. Wilson is super-

intendent of the electric-light and water-works system.

AMES, IA.—Within the next six months the electric light commission expects to install a 500-kw Curtis turbine with Westinghouse condenser, new switchboard, etc., in the municipal electric-light plant; also to purchase within the next 12 months additional boiler equipment, meters, transformers, carload of poles, lightning arresters, one tub transformer, etc. Charles E. Warsaw is superintendent.

CORRECTIONVILLE, IA.—The Town Council has authorized an election to be held during this month to vote on the proposal to issue $15,000 in bonds to purchase the plant of the Union Lt. & Pwr. Co., to be owned and operated by the municipality.

DES MOINES, IA.—The Des Moines El. Co. is contemplating the erection of a high-tension transmission line to Oskaloosa to supply electricity for lamps and motors and to operate the street and interurban railways, work on which will begin next spring. High-tension lines will also be erected to several other cities in the spring. The company is seeking a frachise in Carlisle.

ELDON, IA.—The town of Eldon expects to purchase within the next 12 months a 66-in. by 16-ft. return tubular boiler for the municipal electric-light plant. C. A. Flint is superintendent.

FORT MADISON, IA.—The distribution system of the Fort Madison El. Co. is being rebuilt by the Stone & Webster Engnrg. Corpn., of Boston, Mass.; also a substation to enable the company to distribute energy (25-cycle) which it will purchase from the Mississippi River Pwr. Co. The company, it is expected, will close down the local plant in the near future. Alfred S. Nichols is manager.

MINDEN, IA.—At an election held recently the citizens voted to construct a municipal electric-light plant. John W. Crow is Mayor.

MOUNT VERNON, IA.—The Wapsie Pwr. & Lt. Co., of Mount Vernon, expects to erect about 20 miles of 33,000-volt transmission lines from Stanwood to Lowden and Clarence, Ia., within the next six months; also to purchase material for same, including poles, transformers, lightning arresters, insulators, cable, wire, etc. Kenneth Lindsay is manager.

SHELBY, IA.—The Avoca El. Lt. & Pwr. Co., of Avoca, is erecting a 6600-volt transmission line from its plant in Avoca to Shelby to furnish electrical service here. The franchise was granted Dec. 1, 1913. The plant will be completed by May 1 and the company expects to be able to furnish service here by Feb. 1. Material for this extension has been purchased. W. A. Torrey, of Avoca, is manager.

TRAER, IA.—Within the next four months the Traer El. Co. expects to purchase from 20 to 50 30-ft. steel poles, angle iron, tubular or tripartite. F. L. White is proprietor and manager.

BOONVILLE, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 11, for construction, complete (including mechanical equipment, interior lighting fixtures and approaches), of the United States post office at Boonville, Mo. Drawings and specifications may be obtained from Richards, McCarty & Bulford, architects, Columbus, Ohio, and from the custodian of site at Boonville, or from the above office. O. Wenderoth is supervising architect.

EDINA, MO.—Within the next two months the Edina Lt. Co. expects to purchase one boiler with a rating of from 150 hp to 200 hp; also to purchase within the next three months a series street-lighting system. C. Hunter is secretary.

FARMINGTON, MO.—The City Council is contemplating placing stokers under the boilers in the municipal electric-light plant, consisting of two 72-in. by 18-ft. O'Brien tubular boilers. C. M. Thomsen, superintendent of the municipal plant, would like to receive catalogs, prices, etc., from manufacturers and dealers in stokers.

FULTON, MO.—The Water and Light Department is contemplating the purchase of a new generating unit, consisting of a Corliss engine and generator, directly connected. W. J. McCarroll is superintendent of water and light plant.

LAMAR, MO.—The City Council is contemplating extending the municipal electric distribution system about 6 miles. Steps have been taken by the management of the electric-light plant to introduce electrical heating and cooking apparatus, vacuum cleaners, washing machines, etc. Charles B. Hall is superintendent.

LINN CREEK, MO.—Burns & McDonnell, of Kansas City, Mo., consulting engineers, are making surveys, estimates and preparing report for a 10,000-hp hydro-electric power project in Camden County.

RICHLAND, MO.—The City Council has granted W. I. Diffenderffer, of Lebanon, a 20-year franchise to construct and operate an electric-light system in Richland, subject to the approval of the voters. The Council has also entered into a contract with Mr. Diffenderfer to furnish 12 40-watt street lamps for a period of five years at $24 each per year.

SEDALIA, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 17 for a conduit and wiring system and lighting fixtures in the United States post office, Sedalia, Mo., in accordance with plans and specifications. For details see proposals. O. Wenderoth is supervising architect.

SWEET SPRINGS, MO.—Within the next three months the city of Sweet Springs expects to purchase one 75-kva generator and a 100-hp engine. E. Reans is city clerk.

LEAD, S. D.—The Homestake Mining Co. is reported to be contemplating extensive improvements to its properties, involving an expenditure of $350,000, which will include the installation of a steam electric generating plant, at a cost of $45,000; a boiler plant, to cost $100,000, and a new hoist.

SIOUX FALLS, S. D.—Within the next 12 months the city of Sioux Falls expects to purchase 76 magnetite-arc lamps and iron poles with underground installation and rectifier for 100 lamps. P. O. Hanson is electrician.

YANKTON, S. D.—Bids will be received by the Mount Marty Hospital Association, at the Sacred Heart Hospital, Yankton, S. D., until Feb. 16, for construction of a brick and reinforced-concrete hospital building, including general work, heating, plumbing, electric systems and elevators, in accordance with plans and specifications prepared by Hartford & Jacobson, 601 Capital Bank Building, St. Paul, Minn. Plans are on file at the office of the architects, at the office of D. B. Gurney, Yankton, and at the Builders' Exchange, St. Paul, Minn.

ASHLAND, KAN.—Within the next three months the managers of the municipal electric light plant expect to purchase material for distribution system, including transformers, poles, lightning arresters, insulators, distribution cable and wire, meters, electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. A. W. Hawes is manager.

BLUE RAPIDS, KAN.—Within the next eight months the Marshall County Pwr. & Lt. Co. expects to make extensive repairs to its water-power plant and install two additional waterwheels from 100 hp to 150 hp each, a generator of about 75 amp and additional governor and exciter; also within the next six months to purchase 50 washing machines, 100 irons and cooking devices. The company contemplates extending its service to furnish energy to the mills in Marshall and surrounding towns. J. G. Strong is manager.

DOUGLAS, KAN.—Bids will be received at the office of the city clerk, Douglas, Kan., until Jan. 26, for furnishing material and constructing electric-light plant and water-works system as follows (1) For furnishing all material and labor for constructing power house, low service pump house and pit, settling basin, filter, clear well, filter house and all concrete work; (2) furnishing and installing filter unit, equipment and all piping in filter house; (3) furnishing all machinery and electrical equipment; (4) erecting machinery and electrical equipment; alternate bids for sections 3 and 4, for furnishing and erecting machinery and pumping equipment; (5) furnishing and erecting 50,000-gal. tower and tank 100 ft. high; (6) furnishing and laying water pipes, hydrants and valves; (7) furnishing and erecting one 300,000-gal. filter unit. Plans and specifications are on file at the office of the city clerk, Douglas, and at the office of Albert C. Moore, consulting engineer, Bartlett Building, Joplin, Mo. A complete set of plans may be obtained upon payment of $5 to cover the cost of prints, or $1 for specifications for any one section of specifications. Dr. C. A. Ogg is city clerk.

GARDEN CITY, KAN.—We are informed that the United States Sugar & Land Co., of Garden City, has placed all contracts for its new power plant. F. A. Gillespie is treasurer.

KANSAS CITY, KAN.—Within the next two months the city of Kansas City expects to erect an addition to the municipal power house to provide for increasing the output of the power plant to supply electricity for power purposes; also to install within the next three months one 3000-kva, three-phase, 60-cycle, 2300-volt turbo-generator, and to purchase wire and insulators for 6 miles of 6600-volt transmission line; also to purchase within the next six months coal and ash-handling apparatus to serve 2700 hp in boilers. F. E. Williams is electrical engineer.

LEON, KAN.—Plans and specifications are being prepared by Albert C. Moore, Bartlett Building, Joplin, Mo., for the new municipal electric-light plant and water-works system in Leon. An election will soon be called to vote on the proposal to issue bonds for same.

WELLINGTON, KAN.—Plans are being considered for rebuilding the municipal electric-light plant when the new water-works system is installed, probably some time this year. N. E. Stone is superintendent.

Southern States

BOONE, N. C.—Messrs Hartzog & Moretz, it is reported, are contemplating the installation of a generator to furnish electricity for lighting the town.

ALLENDALE, S. C.—The city of Allendale has awarded the contract to the J. B. McCrary Co., of Atlanta, Ga., for the construction of a municipal electric-light plant. The equipment of the proposed plant will consist of two 80-hp boilers, one 100-hp high-speed automatic engine, one 60-kva generator, directly connected to engine, switchboard, transformers (2200/220/110-volt), 10 miles of No. 8 wire, 200 30-ft. poles and 50 100-watt incandescent street lamps. It is not yet decided when contracts will be awarded.

ATLANTA, GA.—The special committee appointed by Mayor L. C. Hayne to make investigations in regard to the establishment of a municipal electric-light plant has recommended the installation of a lighting plant, the cost not to exceed $250,000. T. W. Pilcher, member of the City Council, is chairman of the committee.

LEESBURG, GA.—The contract for construction of the proposed municipal electric-light plant has been awarded to the J. B. McCrary Co., of Atlanta. The equipment will consist of one 100-hp boiler, one 100-hp high-speed, automatic engine, one 60-kva generator, switchboard, transformers (2200/220/110 volt), 8 miles of wire, 150 30-ft. poles and 30 100-watt incandescent street lamps.

STILLMORE, GA.—Within the next eight months the Stillmore El. Lt. Co. expects to erect a cotton gin, grist mill, planing mill, and also to purchase a 30-hp oil engine and wire for about 1 mile of distribution line. W. L. Clarke is proprietor.

BOCA GRANDE, FLA.—The Charlotte Harbor & Northern Ry. Co. is reported to have awarded a contract to Hampton & Buerke for the installation of an ornamental street-lighting system, Worthington surface condenser, erection of 2 miles of three-phase transmission line, rebuilding present lines, to install 700 kw in transformers and to remodel the electric equipment at the terminals. L. M. Fouts, 5 Nassau Street, New York, N. Y., is general manager.

KEY WEST, FLA.—Bids will be received of the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 31, for the construction of three 300-ft. towers, erected upon concrete foundations furnished by the government at the United States naval station, Key West, Fla., to cost about $15,000, in connection with a station for radio-telegraphic service. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station named. H. R. Stanford is chief of bureau.

HALLS, TENN.—The property of the Halls Lt., Wtr. & Ice Co. was purchased by the city of Hall at a public sale held Jan. 3. Improvements will be made to the plant.

ABERDEEN, MISS.—The electric light and water-works commissioners expect to purchase a 150-hp engine next spring. E. A. Stimson is superintendent.

GREENWOOD, MISS.—The Electric Light and Water Works Commissioners expect to purchase within the next three months a 500-kw, three-phase, 60-cycle, 2400-volt (high-pressure) turbo-generator, with auxiliaries, switchboard, etc. R. Stott is manager.

RULEVILLE, MISS.—Within the next two months the electric-light commission expects to purchase one armature for a 6-kw Wood generator, two transformers, 10 poles, 20 cross-arms and 3000 ft. No. 10 weather-proof wire. O. S. Anderson is superintendent.

PRESCOTT, ARK.—The Board of Electric Light Commissioners expects to purchase within the next six months a 75-kva generator and automatic slide engine (directly connected). A. R. Taylor is superintendent.

RAYNE, LA.—Within the next 30 days the managers of the municipal electric-light plant expect to install one 60-hp Snow crude-oil engine. E. J. Bertrand is superintendent.

CARLSBAD, TEX.—Plans are being considered for the erection of a State Tuberculosis Sanitarium, including lecture hall, storeroom and dormitory to accommodate 50 patients; also steam heat, electric lighting, water-works and sewerage systems, to cost about $30,000. The cost of the buildings is estimated at $34,000. An architect has not yet been selected. George J. Bird, of San Angelo, is vice-chairman.

JEFFERSON, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 20 for changes in plumbing, gas piping, conduit and wiring system and lighting fixtures in the United States post office and court house in Jefferson, Tex., in accordance with plans and specifications. For details see proposal columns. O. Wenderoth is supervising architect.

SAN DIEGO, TEX.—The local electric-light plant, owned by S. G. Smith, has been purchased by Arthur Blankenship, who, it is said, will make improvements to the plant.

TEMPLE, TEX.—The Southwestern Trac. Co., of Temple, is erecting a substation near here to distribute the energy which it will obtain from the power plant of the Temple Pwr. & Lt. Co. in Temple, which will be used to operate the interurban railway of the Southwestern Trac. Co., between Temple and Belton. The old plant of the traction company, 4 miles west of here, will be used for emergency and reserve purposes only.

Pacific States

BELLINGHAM, WASH.—The Puget Sound Trac., Lt. & Pwr. Co. is contemplating making extensive improvements to its local power plant.

SEATTLE, WASH.—The commissioners of King County have granted the Puget Sound Trac., Lt. & Pwr. Co., of Seattle, a franchise to erect transmission lines on 50 county roads in the territory between Bothell, Bellevue, Medina, Lake Sammamish and Lake Washington.

SEATTLE, WASH.—The condemnation of the Lake Cushman power site has been made possible without further bond issue by the passage of an ordinance by the City Council giving the people a right to transfer $200,000 from an issue voted for the Cedar River watershed. The question will be submitted to the voters on March 3.

TACOMA, WASH.—A petition has been presented to Nicholas Lawson, light commissioner, asking for the installation of luminous-arc lamps on Eleventh Street from C to Tacoma Avenue or K Street.

AUMSVILLE, ORE.—Application has been made to the City Council by the Aumsville Flour Mill Co. for a franchise to install and operate an electric-light and power system in Aumsville.

PORTLAND, ORE.—Preparations are being made by the Portland Ry., Lt. & Pwr. Co. to install 200 arc lamps on the east side of the Willamette River, principally in the Lents, Mount Scott and adjoining districts.

BERKELEY, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 18 for the construction, including mechanical equipment and approaches, of the United States post office at Berkeley, Cal. Drawings and specification may be obtained at the above office, or from the custodian of site at Berkeley.

FALL RIVER MILLS, CAL.—The Pit River Pwr. Co., which proposes to build a power plant at Fall River Mills, has applied to the State Railroad Commission for permission to supply electricity in the northeast portion of Shasta County and in Modoc and Lassen Counties.

LINDSAY, CAL.—The State Railroad Commission has granted the Tulare County Pwr. Co., of Lindsay, permission to issue $80,000 in capital stock, the proceeds to be used to enlarge its steam plant and for the erection of new transmission lines and distribution systems.

LOS ANGELES, CAL.—The Vernon substation of the Pacific Lt. & Pwr. Corpn., of Los Angeles, was completely destroyed by fire on Jan. 7, causing a loss of about $68,000.

LOS ANGELES, CAL.—Within the next six months the Nevada-California Pwr. Co., Title Insurance Building, Los Angeles, Cal., expects to erect 160 miles of 55,000-volt transmission line and to purchase six 55,000-volt automatic switches; also one 2000-kva synchronous condenser within the next three months. C. O. Poole is chief engineer.

PASADENA, CAL.—At the present time the city of Pasadena is putting into commission 600 ornamental lamp-posts and is adding 200 meters per month to the municipal electric-lighting system. Within the next two years the city expects to install a 3000-hp crude-oil Diesel engine. C. W. Koiner is general manager of the municipal plant.

REDLANDS, CAL.—Preliminary plans are being made by the Coachella Valley El. & Ice Co., of Redlands, for the erection of a high-tension transmission line from Banning to El Centro, this line running through the Coachella and Imperial Valleys, paralleling the Southern Pacific Railroad. The company will erect a substation and distribution system in the Coachella Valley to serve that territory. The connection with Banning will be with the Southern Sierras Pwr. Co., which is building a transmission line from San Bernardino to that point. It will be a pole line with aluminum wire, to carry 55,000 volts. W. G. Driver is secretary.

SAN FRANCISCO, CAL.—The Ocean Shore R. R. Co. has been authorized to issue $500,000 in bonds, of which the proceeds of $200,000 will be used for electric equipment and for improvement of service. The balance will be reserved for future requirements.

SAN FRANCISCO, CAL.—Within the next 12 months the Coast Valleys Gas & El. Co., 58 Sutter Street, San Francisco, expects to erect 10 miles of 22,000-volt transmission lines and to purchase material for same; also electrical appliances and supplies as required to meet demands. F. J. Blanchard is auditor.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Pwr. Co., 58 Sutter Street, San Francisco, expects to build a pressure pipe 3000 ft. long and from 40-in. to 60-in. in diameter within the next 12 months: also to purchase material for 20 miles of distribution lines and electrical appliances and supplies as demands require. F. J. Blanchard is auditor.

SANTA MARIA, CAL.—Within the next 12 months the Midland Counties Public Service Corp., of Santa Maria, expects to erect about 30 miles of distribution lines: also to purchase electrical heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc., amounting to about $1,000.

WINEHAVEN, CAL.—Plans have been prepared by the California Wine Association for construction of sewer system. 100 reinforced-concrete bungalows, fire-alarm system and equipment, reinforced-concrete social club, administration building, water-works, etc., to cost about $100,000.

BLACKFOOT, IDAHO.—Plans are being considered by D. H. Bietham and others for the construction of a power plant on Warm River to supply electricity in Blackfoot and other nearby towns. It is estimated that 7000 hp can be developed.

BURKE, IDAHO.—The Canyon Creek El. Lt. Co., of Burke, expects to purchase within the next 12 months incandescent lamps, costing about $1,200. E. McHarness is cashier.

NEW MEADOWS, IDAHO.—W. H. Hills and B. Gustad have secured a site on the Little Salmon River, where a hydroelectric power plant will be erected. The plans provide for the construction of a concrete and timber dam with wooden-stave pipes to the power house, the installation o 327-hp turbine and a 250-kw generator and other equipment.

MURRAY, UTAH.—The city of Murray has just completed the construction of a power house, equipped with two generating units of 400 kw each; also erected a double transmission line (6 miles long) to a substation with transformer capacity of 750 kw. The equipment of the power house consists of two Westinghouse generators (400 kw each) directly connected to Pelton-Doble waterwheels of 600 hp each. Dickinson governors are used on the wheels; two Westinghouse exciters (15 kw) and electrolytic type arresters are used at the plant and substation. The city expects to complete about 10 miles of distribution lines in the near future and to purchase a 50-lamp tub transformer for arc-lamp lighting system. Harvey R. Margetts is superintendent.

TEMPE, ARIZ.—The Water Users' Association has awarded the contract for building the concrete foundations for the new crosscut power house, across the Salt River from Tempe, to Martin & Gillis, of Tempe, for $34,000. Seven large sections of concrete founded on rock are to be constructed. The waterwheels and feed pipes will be embedded in the concrete.

DENVER, COL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 16, for the mechanical equipment (except roof drainage and elevators) of the United States post office at Denver, Col. Bids will also be received at the same time and place for an elevator plant. Drawings and specifications may be obtained at the above office or at the office of Tracy, Swartwout & Litchfield, 244 Fifth Avenue, New York. O. Wenderoth is supervising architect.

Canada

CALGARY, ALTA.—The Calgary Pwr. Co., it is reported, contemplates the construction of a dam (100 ft. high) at the outlet of the lake at Kananaskis, to cost about $1,000,000.

POINT GREY, B. C.—Preliminary plans have been prepared by DuCane, Dutcher & Co., Rogers Building, Vancouver, for the construction of a municipal electric-light plant in Point Grey, to cost approximately $240,000.

GRAND FALLS, N. B.—The Grand Falls Co., it is stated, will soon begin work on the construction of large pulp and paper mills in Grand Falls, on the St. John River. It is understood that a large amount of power will be developed and transmitted to towns along the river. Sir William Van Horne is interested in the enterprise.

ELORA, ONT.—The ratepayers on Jan. 5 voted in favor of the by-law authorizing a contract with the Hydro-Electric Power Commission of Ontario for electricity.

HANOVER, ONT.—A by-law submitted to the ratepayers on Jan. 5 authorizing a contract with the Hydro-Electric Power Commission of Ontario for electricity was carried.

KEMPTVILLE, ONT.—The ratepayers on Jan. 5 voted in favor of the bylaw authorizing a contract with the Hydro-Electric Power Commission of Ontario for electricity.

OSHAWA, ONT.—On Jan. 5 a by-law authorizing a contract with the Oshawa El. Lt. Co. to supply electricity to operate the water-works pumping plant was carried.

RICHMOND HILL, ONT.—At the election held Jan. 5 the by-law authorizing an expenditure of $4,000 on an electric-light plant was carried.

STOUFFVILLE, ONT.—On Jan. 5 the by-law authorizing the purchase and improvement of the local electric-light plant, at a cost of $7,000, was carried. The price paid for the plant was $5,000, and the remaining $2,000 will be used for improvements.

STRATHROY, ONT.—A by-law submitted to the ratepayers on Jan. 5, authorizing the city to enter into a contract with the Hydro-Electric Power Commission of Ontario for electricity was carried.

TORONTO, ONT.—The question of utilizing electricity supplied by the Hydro-Electric Power Commission of Ontario was submitted to the voters in eight municipalities and was carried in seven of them. As soon as energy is delivered to these new customers the Hydro-Electric Commission will then give service to 101 cities, towns and villages.

WALLACEBURG, ONT.—At an election held Jan. 5 a by-law authorizing a contract with the Hydro-Electric Power Commission of Ontario for a supply of electricity was carried.

HUMBOLDT, SASK.—A by-law authorizing an expenditure of $20,500 for extensions to the electric-light system has been passed by the ratepayers. C. W. Anderson is Mayor.

WILKIE, SASK.—We are informed that no definite action has been taken (and probably will not be for some months) with regard to extensions and improvements to the municipal electric-light plant, as reported in the issue of Jan. 10. T. A. Dinsley is secretary and treasurer.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Feb. 3, for furnishing motor-driven air compressors, exciter sets, auto-transformers, switchboard, steel rails, pressure oil distributer, agricultural plow, doors, windows, sash and lumber. Blanks and general information relating to this circular (No. 822) may be obtained at the above office. For further details see proposals columns. Major F. C. Boggs is general purchasing officer.

ILOILO, P. I.—The Iloilo El. Co. expects to establish a day service within the next three months and will probably purchase some fans, motors, etc. R. R. London is general manager.

New Incorporations

WILMINGTON, DEL.—The Huntsville Consol. Gas Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 for the purpose of generating and selling gas, electricity and oil for lamps, heaters and motors. The incorporators are: F. D. Buck, B. M. Grawl and G. W. Dillman, of Wilmington.

CHICAGO, ILL.—The Consumers' Pwr. & Lt. Co. has been incorporated with a capital stock of $100,000 to generate electricity for lamps and motors. The incorporators are Jerome N. Frank and Harvey R. Willard.

CISSNA PARK, ILL.—The Electric Service Co. of Cissna Park has been incorporated with a capital stock of $15,000 to generate and distribute electricity in Cissna Park. The incorporators are Ernest F. Lindner, Emma S. Lindner and Dorothy W. Atkins.

URBANA, ILL.—The Champaign County El. Co. has been incorporated with a capital stock of $6,000 to generate and distribute electricity and gas for lamps, heaters and motors; also to distribute water for domestic purposes. The incorporators are William I. Saffall, Lewis E. Ford and C. L. Van Doren.

VINE GROVE, KY.—The Citizens' Ltg. Co. has been organized with a capital stock of $3,000. The company will take over and operate the local electric plant. W. E. Crutcher is interested in the company.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 6, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,083,285. ELECTRICAL IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES; F. Kratz, Stuttgart, Germany. App. filed Dec. 6, 1912. Has supplementary means controlling the electromagnetic interrupter for starting purposes.

1,083,287. PROCESS FOR PRODUCING SOLUBLE POTASSIUM OR SODIUM COMPOUNDS OUT OF FELDSPAR OR MICA OR THE LIKE; A. R. Lindbaid, Ludvika, Sweden. App. filed Oct. 22, 1912. Heats in electric furnace with material which will decompose the silicon dioxide.

1,083,306. ELECTRIC SIGNALING SYSTEM; J. D. Taylor, Edgewood Park, Pa. App. filed April 18, 1908. Rails conductively continuous and having portions of increased impedance consisting of magnetic laminas at the sides of and underneath the rails.

1,083,331. INCANDESCENT ELECTRIC LAMP; T. W. Lowden, London, Eng. App. filed Jan. 14, 1913. Metallic filament having integral portions twisted to form supports for the filament.

1,083,354. INSULATING COMPOUND; T. A. Edison, Llewellyn Park, Orange, N. J App. filed Jan. 27, 1911. Contains tetrachloronaphthalene and asphalt.

1,083,356. STORAGE BATTERY; T. A. Edison, Llewellyn Park, West Orange, N. J. App. filed April 8, 1911. Active material for positive electrode of alkaline storage batteries consisting of nickel hydroxide containing small percentage of cobalt hydroxide.

1,083,375. ELECTRICAL FOOT-WARMER; T. Plimley, Victoria, British Columbia, Canada. App. filed July 28, 1913. Electrically heated foot support for bootblack stand.

1,083,386. ELECTRICALLY HEATED INSTRUMENT; J. A. Chapman, Fort Worth, Tex. App. filed May 6, 1913. Scissors with electrically heated wire exposed along the cutting edge of one blade.

1,083,406. TELEPHONE DESK SET; H. L. Knight and B. W. Sweet, Cleveland, Ohio. App. filed April 19, 1906. Switch, hook and transmitter all supported on a tubular skeleton standard which fits in the hollow column of the instrument.

1,083,418. CONTACT HOLDER; A. Sundh, Yonkers, N. Y. App. filed March 25, 1908. Spirally fluted contact block and correspondingly shaped holder therefor.

1,083,431. AUTOMATIC SWITCH FOR TROLLEY ROADS; R. V. Cheatham, St. Matthews, Ky. App. filed Sept. 2, 1913. Switch-throwing device inoperative as long as a train of cars with trolley wheels is adjacent to the critical part of the trolley wire or track.

1,083,456. TRANSLATING AND SELECTING SYSTEM; E. C. Molina, Boston, Mass. App. filed April 20, 1906. Mechanical selection of lines employed in telephonic transmission.

1,083,520. PORTABLE ELECTRIC LIGHT; C. F. Burgess, Madison, Wis. App. filed July 5, 1912. Has resistance which may be cut in when the battery is new and stronger than the normal intended voltage of the lamp.

1,083,525. SPEED CONTROL FOR MOTOR CARS; S. K. Evans, Elmsford, N. Y. App. filed March 26, 1913. Maximum speed of car is fixed by a lock which sets an adjustable contact in respect to the contact finger of a speedometer.

1,083,534. ELECTRICALLY HEATED FLATIRON; M. I. Grimes, Winthrop, Mass. App. filed May 3, 1913. Rotation of the handle of the iron controls the switch.

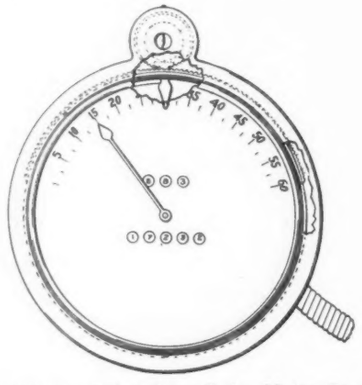
1,083,541. PERFORATING DEVICE; A. Kettnich, Denver, Col. App. filed Feb. 20, 1912. Electromagnets serve, when energized, to project members which form connections from the striker to the punches.

1,083,542. SWITCHING SOCKET OF CONNECTOR; G. C. Knauff, Chicago, Ill. App. filed Feb. 26, 1913. Plug longitudinally movable in the socket for purpose of making or breaking circuit and held locked in either position by bayonet slot construction.

1,083,557. ELECTRICALLY HEATED COOKING APPARATUS; J. W. Phelps, Detroit, Mich. App. filed March 1, 1912. Case clamped in heat-conducting contact with metallic lining of heat-insulating chamber and electric-heating unit secured in recess in outer face of the case.

1,083,566. RELAY; S. R. Stone, New York, N. Y. App. filed Aug. 11, 1911. Double-ended magnet whose opposite poles operate to some extent independently of each other.

1,083,569. PROTECTOR FOR TELEPHONE TRANSMITTER; H. Van Hoevenberg and R. W. Pope, North Elba, N. Y., and Elizabeth, N. J. App. filed May 17, 1913. Closure locked over the mouthpiece of the transmitter to prevent use by unauthorized persons.



1,083,525—Speed Control for Motor Cars

1,083,580. MONITOR; H. C. Zenke, Richmond Hill, N. Y. App. filed Nov. 12, 1910. Record is made upon a chart having a space devoted to each of the several machines supervised by the monitor and a space upon which time record is kept.

1,083,592. ELECTRICAL DRYING OVEN; H. J. Cary-Curr, Elmhurst, Ill. App. filed July 25, 1913. Box vented through top and bottom, rotary regulating valves to bottom vent openings, slab in box wound with resistance wire, switch and automatically operating means in the box for opening switch.

1,083,658. ELECTRIC-ARC LAMP; H. H. Boney, Chicago, Ill. App. filed Sept. 20, 1911. Carbons automatically replaced as they burn out.

1,083,669. ELECTRIC TRAFFIC-CONTROLLING SYSTEM; F. L. Dodgson, Rochester, N. Y. App. filed May 6, 1910. Resistance in the track circuit sufficient to reduce the flow of induced current in the shunt circuit through the relay below the holding valve.

1,083,671. TELEPHONE MOUTHPIECE WITH ANTISEPTIC ATTACHMENT; T. Duquette, Sr., North Grosvenor Dale, Conn. App. filed Sept. 27, 1913. Annular member strung upon telephone mouthpiece and cover hinged thereto and supporting an absorbent body.

1,083,677. METHOD OF PRODUCING HIGH VACUUMS IN X-RAY TUBES AND THE LIKE; C. A. Friedrich, New York, N. Y. App. filed Oct. 11, 1910. Heats to red heat both the anode and cathode during evacuation by means of low potential currents.

1,083,691. PROCESS FOR OBTAINING ALUMINUM; P. C. McIlhiney, Great Neck, N. Y. App. filed Aug. 18, 1913. Includes electrolyzing a fused mixture of the fluorides of aluminum and a fluxing reagent.

1,083,715. TROLLEY; E. Washington, Pittsburgh, Pa. App. filed Aug. 1, 1912. Pivoted spring-closed upstanding retaining jaws overlap the trolley wire.

1,083,726. CIRCUIT-BREAKER CONNECTION FOR ELECTRIC-RAILWAY SYSTEMS; F. E. Case, Schenectady, N. Y. App. filed Nov. 2, 1910. When car passes from one section to another, arcing is avoided by breaking the circuit at a circuit-breaker instead of at the trolley or collector.

1,083,729. DYNAMO-ELECTRIC VARIABLE GEARING; F. Collischonn, Frankfort-on-the-Main, Germany. App. filed June 30, 1909. Electrical change-speed gearing interposed between the engine and the road wheels.

1,083,730. DRIVING MECHANISM FOR MOTOR VEHICLES; F. Collischonn, Frankfort-on-the-Main, Germany. App. filed Feb. 24, 1910. Includes engine-driven generator, electromotors and differential gearing.

1,083,755. INSULATING MATERIAL AND PROCESS OF MAKING THE SAME; J. C. Peabody, Boston, Mass. App. filed Oct. 6, 1910. Adds free resin to paper pulp, beats mixture to distribute uniformly, extracts liquid and subjects to heat and pressure.

1,083,756. CONNECTOR FOR ELECTRIC CONDUITS; J. C. Phelps, Springfield, Mass. App. filed Oct. 23, 1912. Separable cover on the elbow member of the conduits permits the cable to be readily drawn through.

1,083,785. PROCESS FOR PRECIPITATION OF ZINC; F. L. Wilson and S. E. Bretherton, Berkeley, Cal. App. filed Jan. 28, 1913. Adds zinc carbonate and ammonium carbonate to form in the electrolytic zinc bath an ammonium salt which acts as a catalytic agent in the electrolyte.

1,083,788. LOUD-SPEAKING TELEPHONE RECEIVER; C. Adams-Randall, Boston, Mass. App. filed May 16, 1913. Resonator, to which the diaphragm is rigidly connected, takes the place of the usual megaphone.

1,083,817. ELECTRIC HAMMER; J. O. and R. L. Fields, Zanesville, Ohio. App. filed Jan. 13, 1912. Travel of the hammer head is varied by an adjustable contacting device which is actuated by the beam of the hammer.

1,083,822. SPACE BLOCK; H. Geisenhöner, Schenectady, N. Y. App. filed Jan. 16, 1911. Space block secured to the laminations of the rotating body by clips which engage in notches in the space block.

1,083,834. SECONDARY CLOCK; W. M. Jeffreys and W. H. Creahen, Youngstown, Ohio. App. filed Oct. 22, 1912. Designed particularly as a recorder for steam, water and vacuum gages.

1,083,839. TICKET-SALES REGISTER; A. Kiparski, St. Petersburg, Russia. App. filed Oct. 19, 1911. Dials indicate the total number of tickets taken from the various boxes.

1,083,840. AUTOMATIC TICKET REGISTERING AND INDICATING DEVICE; A. Kiparski, St. Petersburg, Russia. App. filed Oct. 19, 1911. Includes contact-making devices actuated by withdrawal of the tickets from the various boxes.

1,083,842. CONTROLLER ATTACHMENT; G. C. Ludgate, Brooklyn, N. Y. App. filed June 3, 1913. Moving controller handle in one direction controls motor and in opposite direction controls air brakes.

1,083,859. HEATING SYSTEM; P. Robert, Paris, France. App. filed May 19, 1911. Provides thermic accumulators with independent heating appliances having electric resistances which utilize the excess of current supplied by hydroelectric or like plant.